NOAA FISHERIES
SEFSC

Fishery-Independent Surveys of the Southeast Fishery Science Center

MSRA Program Review

June 4, 2013

Fishery-independent (FI) surveys conducted by the SEFSC have contributed important data to many stock assessments.

- US Gulf of Mexico stocks
- US South Atlantic stocks
- Some US Caribbean stocks

US Gulf of Mexico

- SEAMAP, a collaboration between the SEFSC and the Gulf States

US South Atlantic

- MARMAP, a state-federal program run by the SC DNR
- SEAMAP, a collaboration between the SEFSC and the South Atlantic states
- SEFIS, Southeast Fishery-Independent Survey group, works cooperatively with MARMAP to complete video surveys

US Caribbean

- There are FI surveys, including SEAMAP surveys, to assess numerous reef fish species using a wide range of gears.

- The SEFSC survey programs provide information that has been useful in numerous stock assessments.
- These programs also provide information on species that may assume greater importance in the future.
- There are extensive opportunities to increase use of the information gathered by these programs.

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 3

SEAMAP

(Southeast Area Monitoring and Assessment Program)

State/Federal/University program for the collection, management and dissemination of fishery-independent data and information in the southeastern United States.

The program presently consists of three operational components: SEAMAP-Gulf of Mexico, which began in 1981; SEAMAP-South Atlantic, implemented in 1983; and SEAMAP-Caribbean, formed in 1988.

SEAMAP

Each SEAMAP component operates independently, planning and conducting surveys and information dissemination in accordance with administrative policies and guidelines of the National Marine Fisheries Service's Southeast Regional Office (SERO).

Activities and operations of each SEAMAP component are wholly defined by the respective managing units: the SEAMAP-Gulf Subcommittee of the Gulf States Marine Fisheries Commission's Technical Coordinating Committee, the SEAMAP-South Atlantic Committee of the Atlantic States Marine Fisheries Commission's South Atlantic State-Federal Fisheries Management Board, and the SEAMAP-Caribbean Committee of the University of Puerto Rico Sea Grant College Program.

SEAMAP

- The Gulf and South Atlantic committees consist of designated representatives from each member state, NMFS, and the Gulf of Mexico and South Atlantic Fishery Management Councils.
- In addition, the SEAMAP-South Atlantic committee includes a representative from the Atlantic States Marine Fisheries Commission.
- The Caribbean component consists of members from the Puerto Rico Department of Natural and Environmental Resources, Virgin Islands Department of Planning and Natural Resources, Puerto Rico Sea Grant College Program, NMFS, U.S. Fish and Wildlife Service, and Caribbean Fishery Management Council.
- Each committee meets yearly to review operations, examine priorities, and plan future activities. Daily operations are carried out by the respective SEAMAP coordinators, assisted by staffs of the two Commissions and Puerto Rico Sea Grant College Program.

Gulf of Mexico

Texas Parks and Wildlife Department

Louisiana Department of Wildlife and Fisheries

University of Southern Mississippi, Gulf Coast Research Laboratory

Alabama Department of Conservation and Natural Resources, Marine Resources Division

Florida Fish and Wildlife Conservation Commission

Gulf of Mexico Fishery Management Council

Gulf States Marine Fisheries Commission

National Marine Fisheries Service

South Atlantic

North Carolina Division of Marine Resources

South Carolina Department of Natural Resources

Georgia Department of Natural Resources

Florida Fish and Wildlife Conservation Commission

South Atlantic Fishery Management Council

Atlantic States Marine Fisheries Commission

National Marine Fisheries Service

Caribbean

Puerto Rico Department of Natural and Environmental Resources

Virgin Islands Department of Planning and Natural Resources

Puerto Rico Sea Grant College Program

Caribbean Fishery Management Council

U.S. Fish and Wildlife Service

National Marine Fisheries Service

Presentation Layout

Due to the numerous survey types employed by the SEFSC, the FI surveys to be discussed today are divided into the following groups:

- Trawling Surveys
- Plankton Surveys
- Longline Surveys
- Video, Trap, ROV, and Vertical Line Surveys
- Caribbean Surveys, Visual Surveys, and Other Surveys

Presentation Layout cont.

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The following items are covered for our main large-scale surveys:

- Objectives
- Collaborations
- Summary
- Survey Design and Gears
- Useful in Assessments
- Improvements and Future Directions
- QA/QC of data will be covered in a different presentation tomorrow.

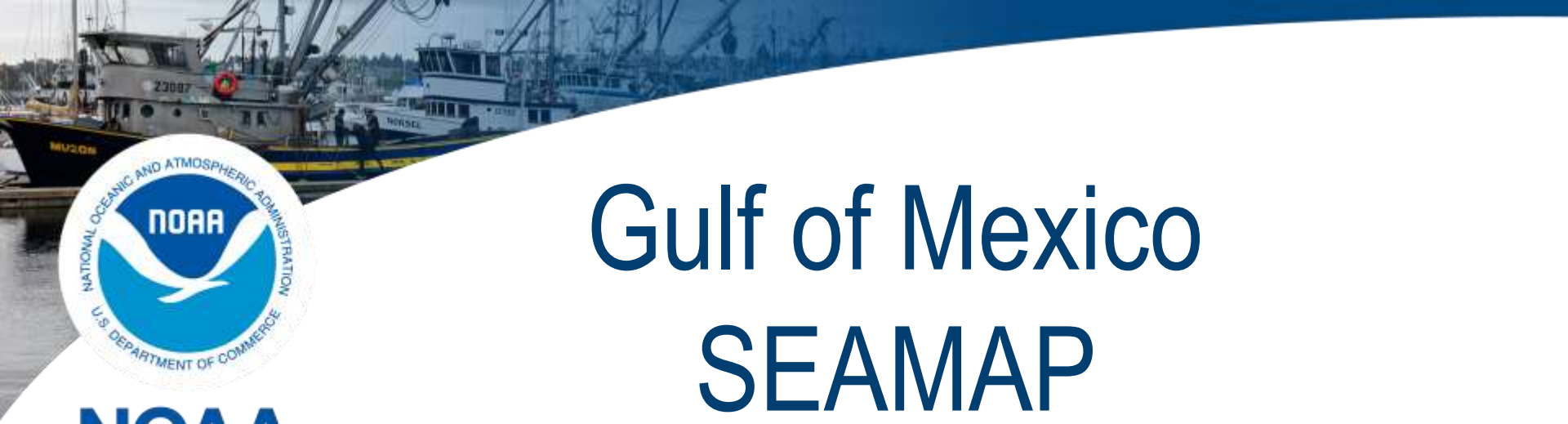
For other surveys, a subset of the above items are provided.

SEFSC Trawling Surveys

Survey	Description	Area of Operation	Frequency
SEAMAP Groundfish Survey	Survey abundance and distribution of benthic fauna in the U.S. Gulf of Mexico in depths of 5-60 fathoms.	U.S. Gulf of Mexico in depths of 5-60 fathoms.	Annual Summer (Jun, Jul) and Fall (Oct-Nov)
SEAMAP Groundfish/Shrimp Trawls Survey (Alabama)	Survey monitors the abundance and distribution of benthic fauna off Alabama and Florida in state and federal waters in depths of 5-60 fathoms.	Mississippi, Alabama and Florida in state and federal waters in depths of 5-60 fathoms.	Annual, Summer (Jun-Jul) and Fall (Oct-Nov)
SEAMAP Summer Groundfish/Shrimp Trawls Survey (Florida)	Surveys the abundance and distribution of benthic fauna off in the eastern Gulf of Mexico from the Florida/Alabama border to Dry Tortugas, Florida, in depths of 30-360 ft.	Florida/Alabama border to Dry Tortugas, FL, in depths of 30-360 ft. Sampling occurs during day and night hours.	Annual, Jun-Jul
SEAMAP Offshore Groundfish/Shrimp Trawls Survey (Mississippi)	Survey monitors the abundance and distribution of benthic fauna off Mississippi and Alabama in state and federal waters in depths of 6-200 ft.	Mississippi and Alabama in state and federal waters in depths of 6-200 ft.	Annual, Summer (Jun) and Fall (Oct)
SEAMAP Groundfish/Shrimp Trawls Survey (Louisiana)	Surveys abundance and distribution of benthic fauna off Louisiana, west of the Mississippi River in state and federal waters in depths of 6-200 ft.	Louisiana waters west of the Mississippi River in state and federal waters in depths of 6-200 ft.	Annual, Summer (Jun-Jul) and Fall (Oct-Nov)
SEAMAP Groundfish/Shrimp Trawls Survey (Texas)	Surveys abundance and distribution of benthic fauna in five specific sampling areas along the Texas coast, from the border of Louisiana to the border of Mexico. Sampling occurs in state waters and within nine nautical miles of shore.	Five sampling areas along the Texas coast, from the Louisiana border to Mexico: Sabine Pass, Aransas Pass, Bolivar Pass, Matagorda Pass, and border with Mexico. Sampling depths 6-96 ft.	Annual, Summer (Jun-Jul) and Fall (Oct-Nov)

SEFSC Trawling Surveys cont.

SEAMAP Small Pelagic Survey	Survey compliments the Fall Shrimp/Bottomfish survey and monitors the abundance and distribution of small pelagics (scad, herring, butterfish, etc.) in the Gulf of Mexico.	U.S. Gulf of Mexico in depths of 50-500 meters.	Annual, Oct-Nov
SEAMAP South Atlantic Coastal Trawl Survey (SC)	Surveys the distribution and relative abundance of resident and transient fishes, elasmobranchs, decapod and stomatopod crustaceans, sea turtles, horseshoe crabs, and cephalopods that are accessible by high-rise trawls. Additional data are recorded for priority species include measurements of length or width for all priority species, sex and individual weights for blue crab, sharks, and horseshoe crabs, and reproductive information on commercially important penaeid shrimp and blue crabs.	Cape Hatteras, North Carolina (35˚ 13.2'N) and Cape Canaveral, Florida (28˚30.0'N)	Annual, Apr-May (Spring), Jul-Aug (Summer), and Oct-Nov (Fall)
Panama City Juvenile Reef Fish Trawl Survey	Surveys seagrass habitats for juvenile reef fish to gain inference on temporal and spatial variability of recruitment.	St. Andrew Bay, Florida	Annual, May-Nov
SEAMAP-SA North Carolina Pamlico Sound Survey	Trawl survey to monitor juvenile fish, shrimp, and crab abundance in Pamlico Sound and its bays and rivers.	Pamlico Sound and the Pamlico, Pungo, and Neuse rivers in waters ≥6 feet in depth.	Annual, Jun and Sep



NOAA FISHERIES
SEFSC

Gulf of Mexico SEAMAP Trawling Surveys

- Shrimp/Bottomfish
  - Summer
  - Fall
- Small Pelagics/Acoustics
  - Fall

Objectives - Shrimp/Bottomfish

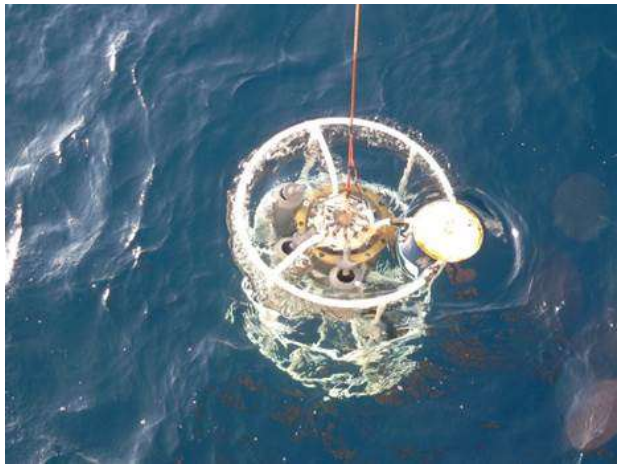
- Summer and Fall
  - Assess the abundance and distribution of demersal fauna in the US Gulf of Mexico
  - Collect size, sex, maturation and life history data of sampled species
  - Collect ichthyoplankton samples and data
  - Profile the water column at each sample site for temperature, salinity, dissolved oxygen, percent light transmission and fluorescence
- Summer Only
  - Estimate indices of relative abundance and population size structure of brown, white and pink shrimp off the Texas coast
  - Collect hydrographic data to map the hypoxic zone which occurs in the northern GOM

Summary - Shrimp/Bottomfish - Summer

- Time series: 1982-present
- Collaborating agency: SEAMAP-Gulf of Mexico
- 40 days at sea - NOAA Ship *Oregon II*
- Area of focus: US Gulf of Mexico, Texas to Florida
- Depths: 9-110 meters (5-60 fathoms)

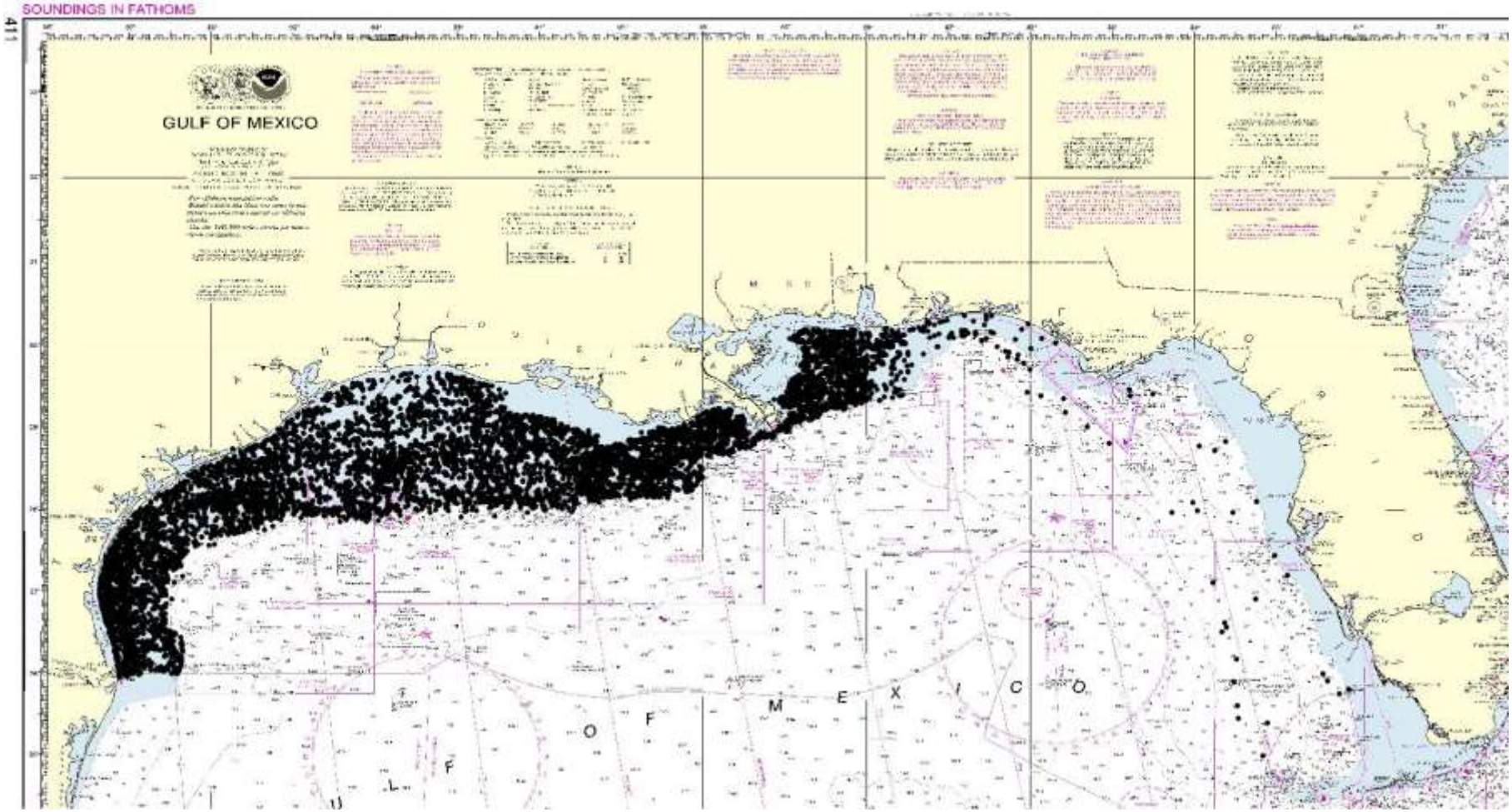
Survey Design - Shrimp/Bottomfish - Summer

- Random sampling with proportional allocation according to surface area, within 38 allocation units (2 depths; 9-37, 37-110m (5-20, 20-60fms)) and 19 shrimp statistical zones (zones 3 through 21)
- 300-350 stations per survey
- 42-ft shrimp trawl
- In 2013 SEAMAP will start consistently sampling waters in the 2-5 fathom range across the Gulf.
  - SEAMAP had done this off LA in years past with MS coming over to LA and sampling 5-10 stations across the coast.
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer



Survey Design - Shrimp/Bottomfish – Summer cont.

Spatial Coverage



Stock Assessment Species - Shrimp/Bottomfish – Summer

- Red Snapper
- Gray Triggerfish
- Vermilion snapper
- Greater amberjack
- King & Spanish mackerel
- Several shark species
- Brown, White, Pink Shrimp

Survey History - Shrimp/Bottomfish – Summer

- Began in 1982 to assess the effectiveness of the Texas Closure shrimp management technique initiated in 1981
- 1982-1986
  - Random sampling within 115 cells, 1 sample per cell
  - 5 area (statistical zones 11, 13-15, 16&17, 18&19, 20&21)
  - 23 depths (5-6, 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, 12-13, 13-14, 14-15, 15-16, 16-17, 17-18, 18-19, 19-20, 20-22, 22-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-60 fms)
  - Sampled at night only
  - Measured a maximum of 200 individuals per species of brown, white, and pink shrimp
  - Minimum tow time 10 minutes, maximum 30

Survey History - Shrimp/Bottomfish – Summer cont.

- 1987 – 2008 Used SEAMAP sampling protocol
  - 24-hour sampling thus doubling sampling cells
  - Minimum tow 10 minutes, maximum 55 to comply with TED exemption
  - Sampled across depth strata even if multiple tows required
  - Measured a maximum number of 20 individuals of non-shrimp species and collected supplemental data on every fifth individual measured (individual weight, sex, and sexual maturity)

Survey History - Shrimp/Bottomfish – Summer cont.

- 2009 – present, SEAMAP protocols modified
  - Day/night allocation abandoned in favor of post-survey determination according to time at which tows occurred
  - Variable length tow durations fixed to 30 minutes
  - Random sampling with proportional allocation according to surface area, within 38 cells
    - 2 depths; 9-37, 37-110m (5-20, 20-60fms))
    - 19 shrimp statistical zones (zones 3 through 21)
  - Survey area extended eastward to include the Florida coast – this began 2008

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Summer

- Weaknesses
  - Texas does not use standard SEAMAP sampling gear nor utilize the SEAMAP sampling design (Texas coast sampled by NMFS)
  - Insufficient number of days at sea during years of hurricanes, equipment failures, or other catastrophic events
  - No sediment/bottom type data collection
  - Don’t utilize net mensuration equipment nor acoustic sampling
  - Yet to determine catchability coefficient of sampling net

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Summer cont.

- Strengths
  - 30 year time series
  - Probability based sample design
  - Participation by all Gulf states through SEAMAP
  - Use of standardized gear and sampling design (except Texas)
  - Although commercial shrimp species are emphasized this is a multi-species survey
  - Data used in over 10 stock assessments
  - Collaborate with NOAA's National Coastal Data Development Center (Hypoxia Watch) in mapping the hypoxic zone
  - Electronically record data through the Scientific Computing System and Fishery Scientific Computing System which utilizes real time data checks

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Summer cont.

- Improvements
  - Encourage Texas to use standard SEAMAP sampling gear and design
  - Request additional sea days to ensure complete coverage
  - Collect sediment classification data using ship-board acoustic sensors
  - Obtain net mensuration equipment to assure proper fishing configuration of sampling trawl
  - Utilize acoustic sensors to estimate catchability coefficients for stock assessment species

Summary - Shrimp/Bottomfish - Fall

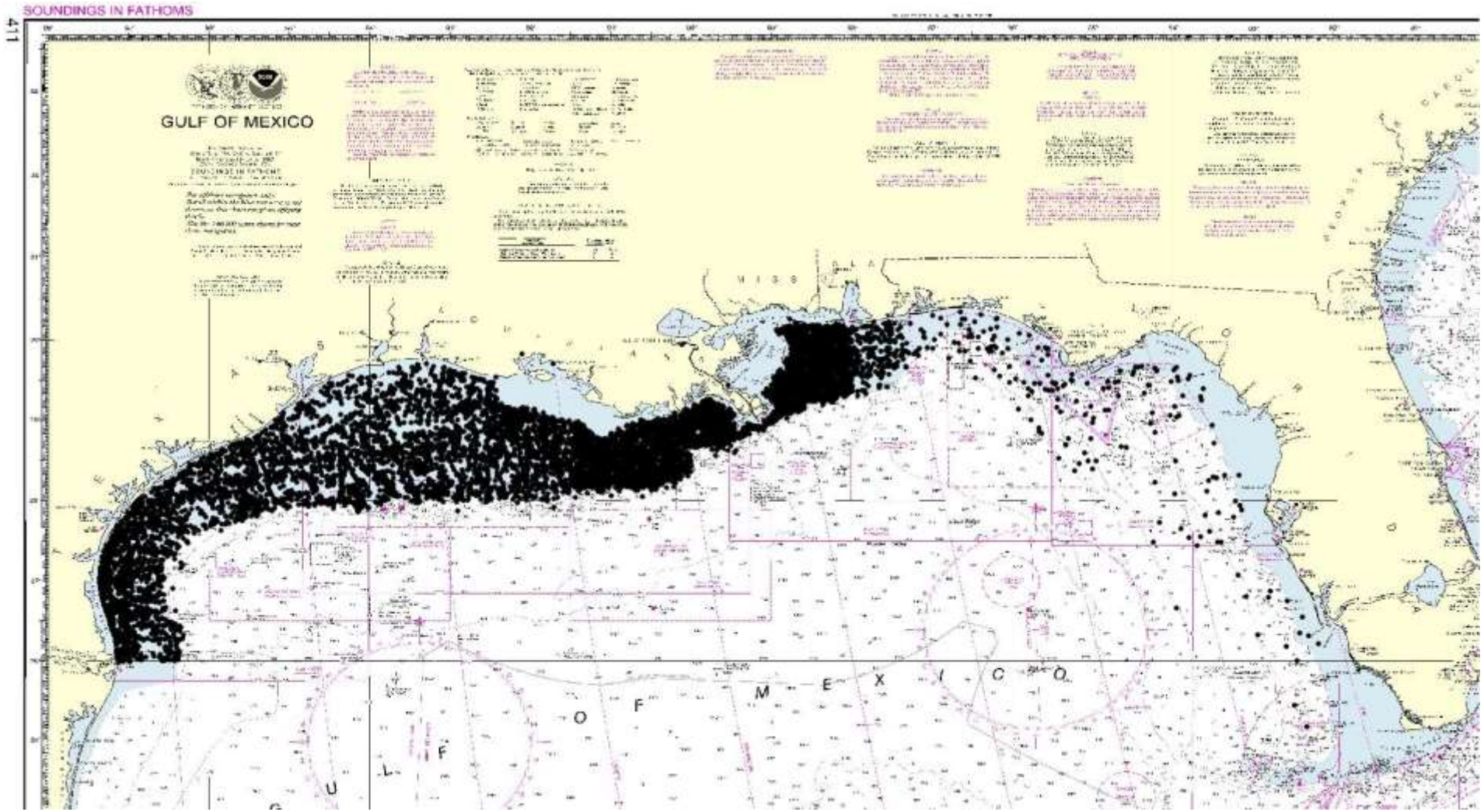
- Time Series: 1972-present
- Collaborating agency: SEAMAP – Gulf of Mexico
- 41 days at sea – NOAA Ship *Oregon II*
- Area of focus: US Gulf of Mexico, Texas to Florida
- Depths: 9-110m (5-60 fms)

Survey Design - Shrimp/Bottomfish - Fall

- Random sampling with proportional allocation according to surface area, within 38 allocation units (2 depths; 9-37, 37-110m (5-20, 20-60fms)) and 19 shrimp statistical zones (zones 3 through 21)
- 300-350 stations per survey
- 42-ft shrimp trawl
- In 2013 SEAMAP will start consistently sampling waters in the 2-5 fathom range across the Gulf.
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer

Survey Design - Shrimp/Bottomfish – Fall cont.

Spatial Coverage



Stock Assessment Species - Shrimp/Bottomfish – Fall

- Red Snapper
- Gray Triggerfish
- Vermilion snapper
- Greater amberjack
- King & Spanish mackerel
- Several shark species
- Brown, White, Pink Shrimp

Survey History - Shrimp/Bottomfish – Fall

- Began in 1972 in response to reports of declining biomass from boats operating in the petfood and foodfish fisheries
- 1972-1984
  - Survey area defined as the northcentral GOM (88°00´-91°30´W Lon) between 9-92m (5-50fms)
  - Sampling sites selected randomly using a grid system
  - Conducted 3 10-minute tows at each sampling site
  - Measured most abundant species per sampling site as time allowed
- 1985-1986
  - Sampling intensity reduced to 1 15-minute tow per sampling site
  - Survey area extended;
    - westward to include the Texas coast
    - Bathymetrically to 183m (100 fms)

Survey History - Shrimp/Bottomfish – Fall cont.

- 1987-2008: Used SEAMAP sampling protocol
  - Random sampling within 230 cells, 1 sample per cell
  - 2 diurnal periods (day, night)
  - 5 areas (statistical zones 11, 13-15, 16&17, 18&19, 20&21)
  - 23 depths (5-6, 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, 12-13, 13-14, 14-15, 15-16, 16-17, 17-18, 18-19, 19-20, 20-22, 22-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-60 fms)
  - Minimum tow 10 minutes, maximum 55 to comply with TED exemption
  - Sampled across depth strata even if multiple tows required
  - Measured a maximum number of 20 individuals of all species and collected supplemental data on every fifth individual measured (individual weight, sex, and sexual maturity)

Survey History - Shrimp/Bottomfish – Fall cont.

- 2009-present SEAMAP protocol modified
  - Day/night allocation abandoned in favor of post-survey determination according to time at which tows occurred
  - Variable length tow durations fixed to 30 minutes
  - Random sampling with proportional allocation according to surface area, within 38 cells
    - 2 depths; 9-37, 37-110m (5-20, 20-60fms))
    - 19 shrimp statistical zones (zones 3 through 21)
  - Survey area extended eastward to include the Florida coast

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Fall

- Weaknesses
  - Texas does not use standard SEAMAP sampling gear nor utilize the SEAMAP sampling design (Texas coast sampled by NMFS)
  - Insufficient number of days at sea during years of hurricanes, equipment failures, or other catastrophic events
  - No sediment/bottom type data collection
  - Don’t utilize net mensuration equipment nor acoustic sampling
  - Yet to determine catchability coefficient of sampling net

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Fall cont.

- Strengths
  - 40 year time series
  - Probability based sample design
  - Participation by all Gulf states through SEAMAP
  - Use of standardized gear and sampling design (except Texas)
  - Multi-species survey
  - Data used in over 10 stock assessments
  - Electronically record data through the Scientific Computing System and Fishery Scientific Computing System which utilizes real time data checks

Strengths, Weakness, Improvements – Shrimp/Bottomfish – Fall cont.

- Improvements
  - Encourage Texas to use standard SEAMAP sampling gear and design
  - Request additional sea days to ensure complete coverage
  - Collect sediment classification data using ship-board acoustic sensors
  - Obtain net mensuration equipment to assure proper fishing configuration of sampling trawl
  - Utilize acoustic sensors to estimate catchability coefficients for stock assessment species

Objectives - Small Pelagics/Acoustics

- Assess the abundance and distribution of demersal and small pelagic species in the US Gulf of Mexico between 50-500 meters (27-273 fathoms)
- Collect size, sex, maturation and life history data of sampled species
- Collect ichthyoplankton samples and data
- Profile the water column at each sample site for temperature, salinity, dissolved oxygen, percent light transmission and fluorescence
- Extend the bathymetric coverage of the Fall SEAMAP Shrimp/Bottomfish Survey

Summary - Small Pelagics/Acoustics

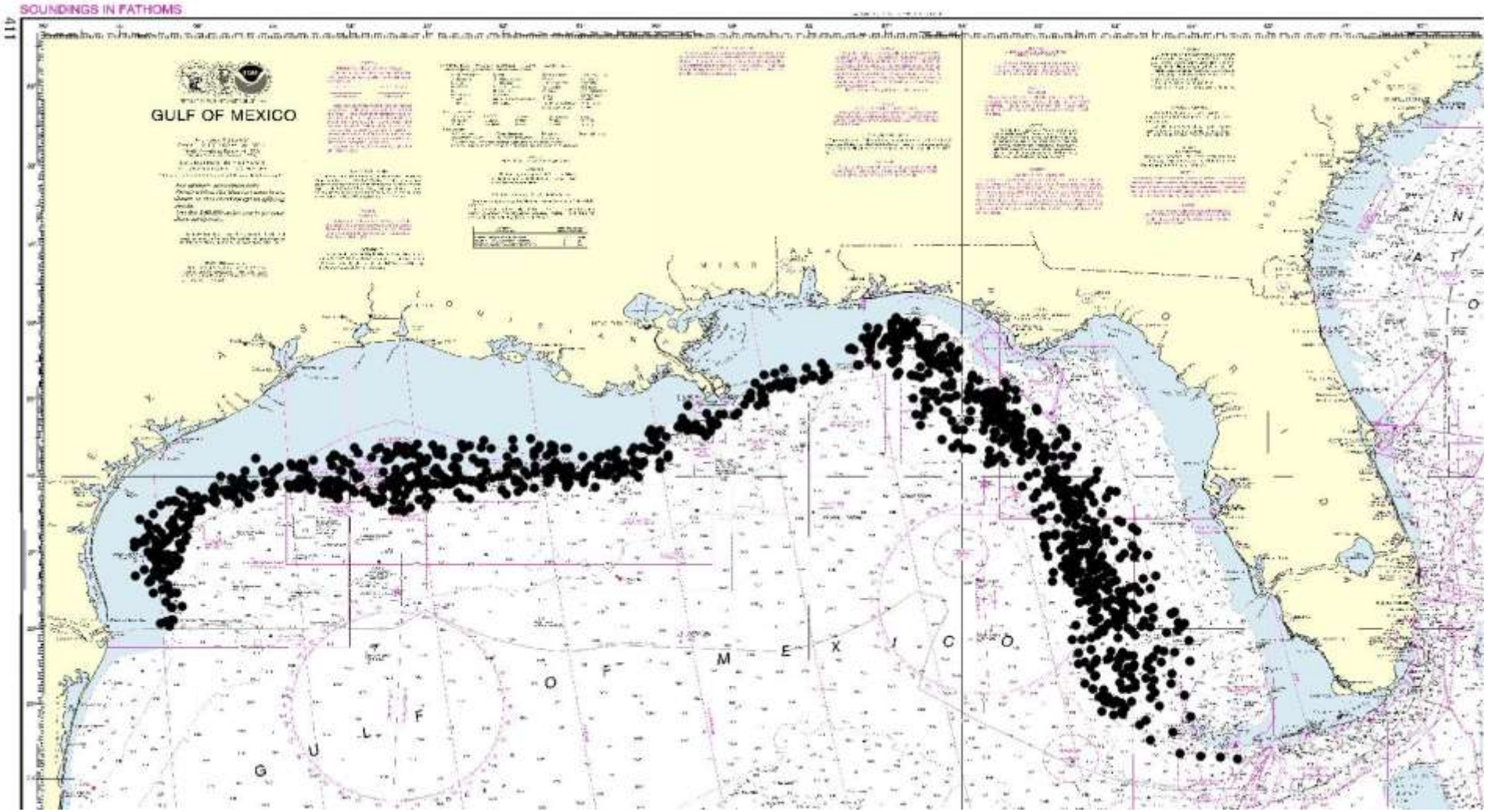
- Time Series: 2002-present
- 40 days at sea – NOAA Ships *Pisces* and *Gordon Gunter*
- Area of focus: US Gulf of Mexico, Texas to Florida
- Depths: 50-500m (27-273fms)

Survey Design - Small Pelagics/Acoustics

- Random sampling with proportional allocation according to surface area, with 57 allocation units
  - 3 depths; 50-110 (27-60fms), 110-200 (60-109fms), and 200-500m (109-273fms)
  - 19 shrimp statistical zones (zones 3 through 21)
- 155 stations per survey
- 90-ft high-opening bottom trawl
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer

Survey Design - Small Pelagics/Acoustics cont.

Spatial Coverage



Stock Assessment Species - Small Pelagics/Acoustics

Red Snapper

Gray Triggerfish

Vermilion snapper

Greater amberjack

King mackerel

Survey History - Small Pelagics/Acoustics

- Began in 1992 to investigate the abundance and distribution of the coastal small pelagics complex in the US GOM
- 1992-2002
  - Data are imbalanced in time and space because of varying survey objectives, temporal limitations, mechanical failures and logistical constraints.
  - Sampling designs varied among stratified random, two dimensional systematic and systematic random.
  - Sampled from 10 to 420m (5-230fms)
  - 30 minute tows
- 2002-present
  - Statistical zones 1 and 2 were deleted from the sampling universe due to frequent damage to sampling gear
  - Bathymetric boundaries were changed to 50-500m (27-273fms)

Strengths, Weakness, Improvements - Small Pelagics/Acoustics

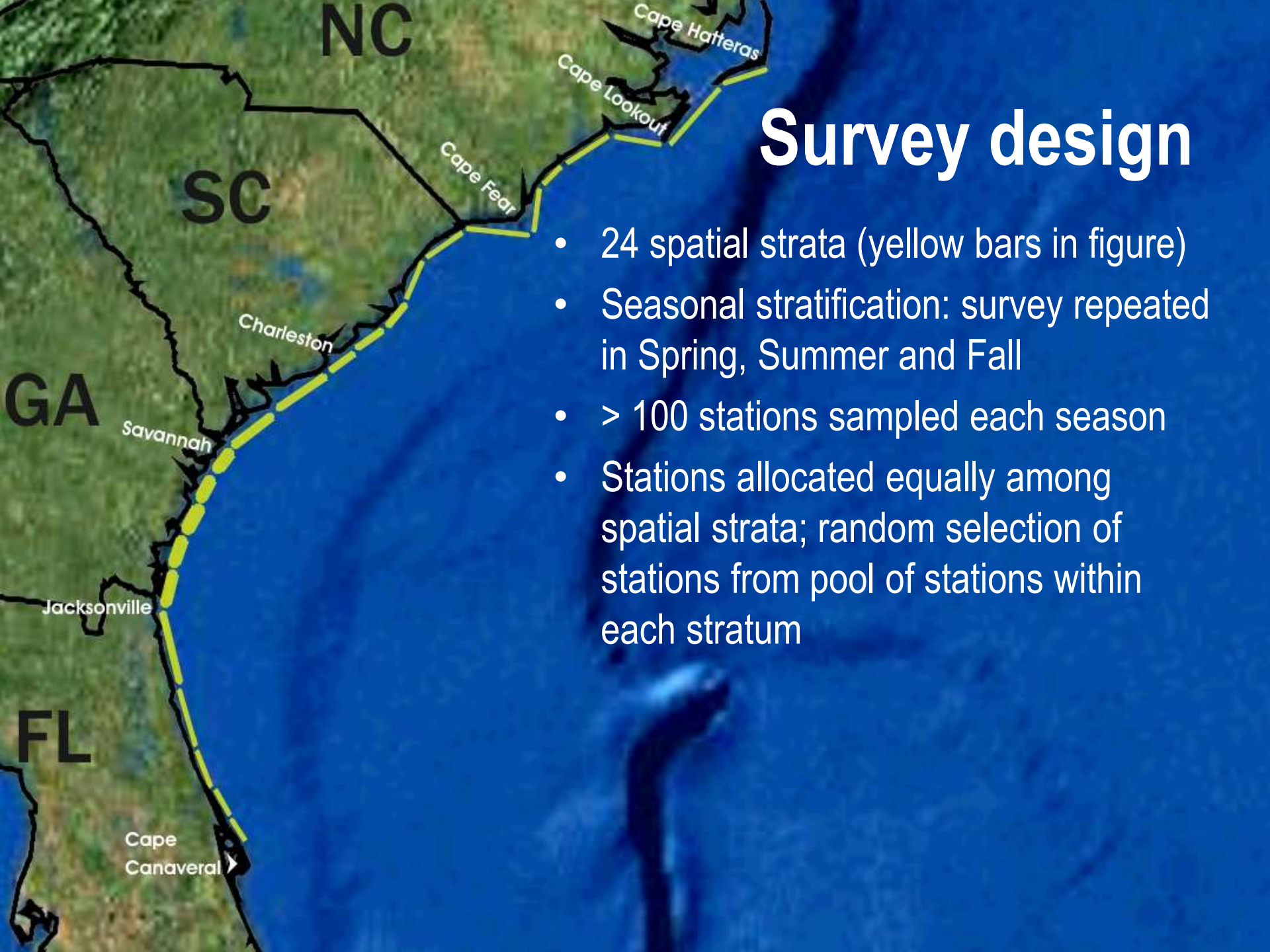
- Weaknesses
  - Insufficient number of days at sea during years of hurricanes, equipment failures, or other catastrophic events
  - No sediment/bottom type data collection
  - Yet to determine catchability coefficient of sampling net
- Strengths
  - 10 year time series
  - Probability based sample design
  - Multi-species survey
  - Electronically record data through the Scientific Computing System and Fishery Scientific Computing System which utilizes real time data checks
- Improvements
  - Request additional sea days to ensure complete coverage
  - Collect sediment classification data using ship-board acoustic sensors
  - Utilize acoustic sensors to estimate catchability coefficients for sampling net, and estimate biomass

SEAMAP-South Atlantic Coastal Trawl Survey

Multi-species survey targeting species utilizing unstructured habitats in nearshore waters

Summary Information

- Time series: 1986-present
- Coordinating agency: SEAMAP-South Atlantic
- Area of focus: Cape Hatteras, NC to Cape Canaveral, FL
- Depths: ~ 4.5-9m (15-30')



Survey design

- 24 spatial strata (yellow bars in figure)
- Seasonal stratification: survey repeated in Spring, Summer and Fall
- > 100 stations sampled each season
- Stations allocated equally among spatial strata; random selection of stations from pool of stations within each stratum

Gear

- Paired 22.9-m (75-foot) mongoose-type Falcon trawl nets
- Trawl body = 47.6mm mesh
- Cod end = 41.3mm stretch mesh
- Trawl duration = 20 minutes

Used in assessments

- MSRA: Spanish mackerel
- Other (State or ASMFC):
  - Atlantic croaker
  - Multiple shrimp species
  - Weakfish
  - Horseshoe crab
  - Coastal sharks

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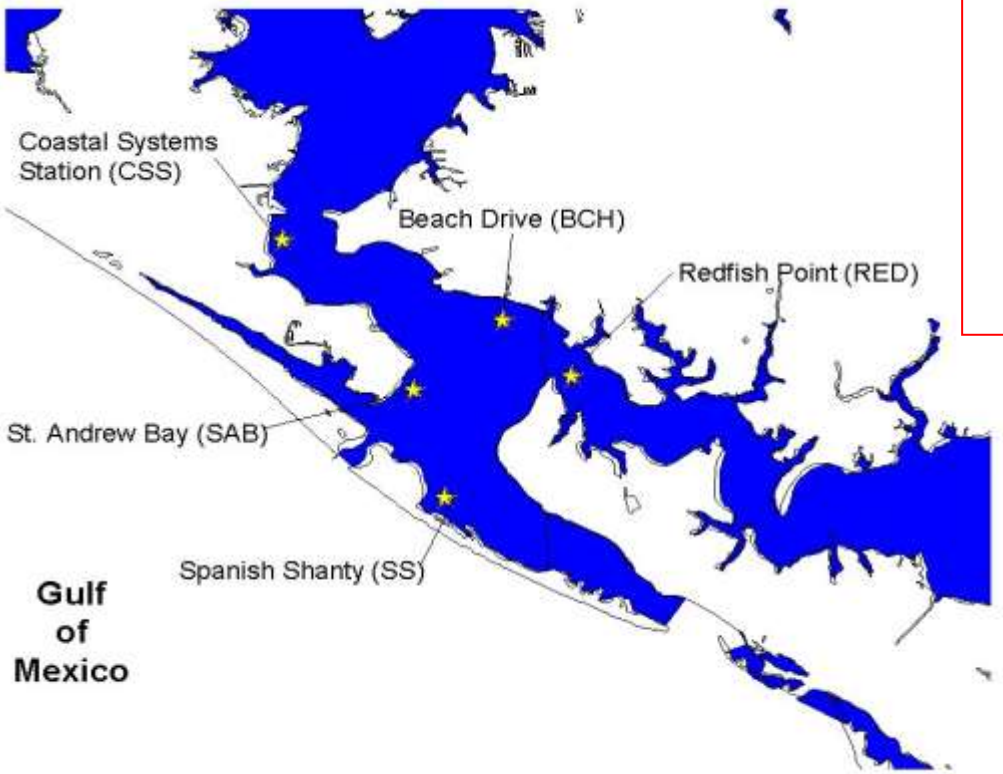
Panama City Juvenile Reef Fish Trawl Survey

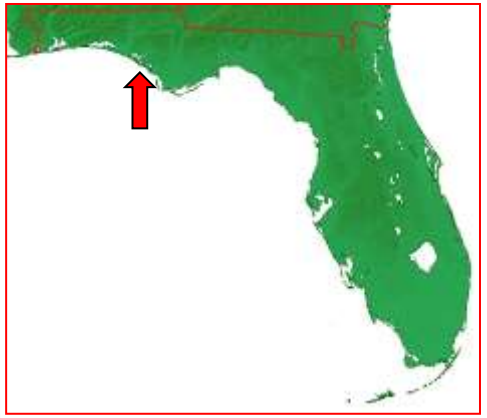
Objective: Provide temporal and spatial variation of density of juvenile reef fish (and other species) in seagrass habitat of St. Andrew Bay, FL.

Summary and Survey Design

- Benthic scrape towed behind a boat (1 m wide opening, 17’ long)
- 50 m trawls (a buoy was placed at the beginning each station, so that exact distance could be measured at the end of the tow with a laser rangefinder)
- Trawls sorted for lane snapper, gray snapper, & gag grouper on boat
- Snapper & grouper were measured to nearest tenth of a mm (SL), enumerated, and released if alive
- Other data collected include temperature and salinity

Summary and Survey Design





- Sampled at least once a week from May to November 1997 – 2009, 2011
- 1997-2001: 10 stations @ SAB seagrass bed only (see map)
- 2002-2011: between 2-5 stations at each of 5 seagrass beds throughout the bay SAB – 5 stations; CSS, BCH, SS – 3 stations; RED – 2 stations
- Number of stations was determined by seagrass bed size

Use in Assessments

This survey provides temporal and spatial variation of densities of juvenile reef fishes (e.g. groupers and snappers) in St. Andrew Bay, FL seagrass beds.

Data from this survey has been utilized in stock assessments for gag grouper.

SEFSC Plankton Surveys

Survey	Description	Area of Operation	Frequency
SEAMAP Plankton Survey	Surveys the occurrence, abundance and geographical distribution of the early life stages of fishes. The pelagic habitat of fish larvae are recorded through measurements of various physical and biological parameters. Map the distribution of fish eggs along the cruise track using a Continuous Underway Fish Egg Sampler (CUFES).	Coastal, shelf and open ocean waters of the Gulf of Mexico	Annual, Feb-Mar (Winter), Apr-May (Spring), and Aug-Sep (Fall)
SEAMAP GOM Offshore Ichthyoplankton survey (Mississippi and Louisiana)	Surveys ichthyoplankton eggs and larvae in the spring and fall (May and September, respectively) off Alabama, Mississippi, and Louisiana.	State and federal waters off Alabama, Mississippi, and Louisiana.	Annual, May-Jun and Sept-Oct
SEAMAP-GOM Ichthyoplankton survey (Alabama & Florida)	Ichthyoplankton surveys to collect larvae for red drum, king mackerel and other species. Florida has not collected since 2001.	State waters off Alabama out to 360 ft in depth. There are nine fixed stations near Mobile Bay, AL and from Alabama to Dry Tortugas, FL.	Annual, Aug-Sept
Ichthyoplankton Sampling Beaufort (NC)	Fall and winter surveys of ichthyoplankton larvae from Pivers Island Bridge. Represents a 26-year time series of larval fish ingress through Beaufort Inlet.	Pivers Island Bridge, NOAA Beaufort facility, Beaufort, NC	Annual, Nov-May (some years monthly Jan-Dec)
Caribbean Recruitment Experiment	Surveys ichthyoplankton forms of coral reef fish species in the U.S. Caribbean; develops larval indices for snapper, parrot fish, and grouper; and determines seasonal abundances, and population connections between islands and with the upstream sources.	Caribbean and Mexican waters	Bi-Annual, Feb or Jun

SEFSC Plankton Surveys

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Objectives:

- Assemble and maintain a consistent time series of data/observations on the occurrence, abundance, distribution and habitat of the early life stages of fishes, decapod crustaceans and invertebrate zooplankton in the Gulf of Mexico

- Collect environmental data in order to determine the influence of those factors on distribution patterns, survival and, therefore, estimates of abundance of select taxa
- Provide annual estimates of larval fish abundance from SEAMAP surveys for use as fishery independent indices of spawning stock size

Collaborators

- Plankton sample and at-sea data collection conducted by NMFS and the resource agencies (or their designee) of the states of Louisiana, Mississippi (Gulf Coast Research Lab), Alabama, and Florida (FL through 2001) under the Joint Federal-State program known as SEAMAP (Southeast Area Monitoring and Assessment Program)

- Sample analyses at the Plankton Sorting and Identification Center (ZSIOP) in Szczecin and Gdynia, Poland

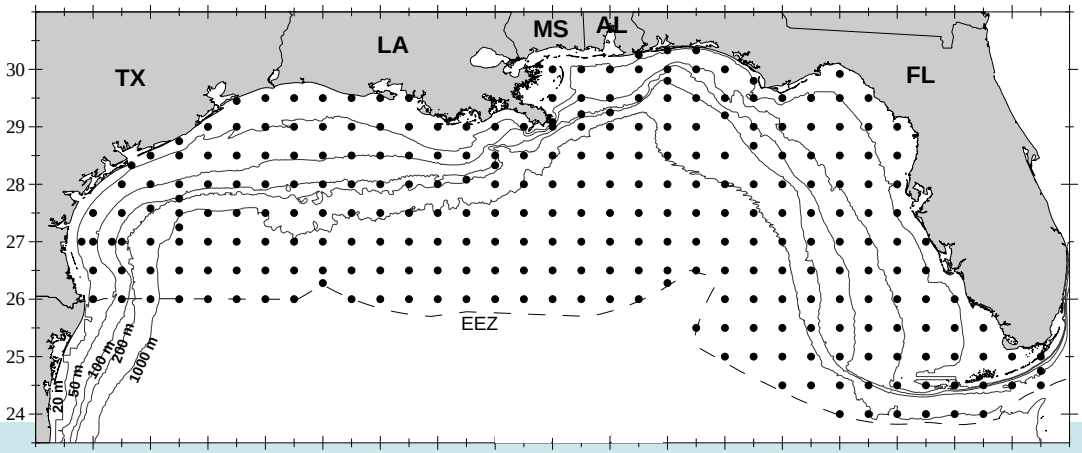
- Sample and specimen archival at SEAMAP Archiving Center, Florida Fisheries and Wildlife Commission, St. Petersburg FL; and SEAMAP Invertebrate Plankton Archiving Center (SIPAC), USM/Gulf Coast Research Laboratory, Ocean Springs, MS

Summary

- Time series: 1982 to present
- Current DAS/Vessels: ~30-35days for each of three dedicated plankton surveys on NOAA vessels; 2-5 days per state partner on Gulf state vessels
- Area: NMFS Gulf-wide, shelf and/or offshore waters out to U.S. EEZ (depending on survey); Gulf state agencies, state coastal waters primarily

Survey Design

- Fixed, systematic grid, 300 SEAMAP stations from 10 m out to U.S. EEZ (not all stations sampled during all surveys)
- Most stations located at 30 nm (56 km) or 0.5° intervals
- Spring : April to early June, annually since 1982, open Gulf waters
- Fall: late August to mid October, annually since 1986, coastal & shelf waters south TX to south FL
- Winter: January through March, 1982-85, 1993, 1996, 2007-2009, 2010, 2012 & 2013 in shelf and open Gulf waters



Plankton Sampling Gear

Primary Sampling Gear

- 61 cm bongo frame, 0.335 mm mesh net, double-oblique tow path from a maximum depth of 200 m or 2–5 m off the bottom at depths <200 m.
- 2x1 m pipe frame neuston net, 0.950 mm mesh net, towed at the surface with the frame half-submerged for 10 min.

Secondary Sampling Gear

- 1m^2 MOCNESS (multiple opening/closing net and environmental sensing system), 0.505 mm mesh net, towed horizontally at discrete depths bins.
- CUFES (continuous underway fish egg sampler), 0.505 mm mesh net, samples collected through ship's sea chest, depth = 3 m, continuous collection along ship's track.
- 1x2 m 'Spanish(subsurface) neuston'net, 0.505 mm mesh net, fished down and up to 10 m depth for 10 min.

Environmental Sampling Gear

- Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer
- SeaCat SBE19, real time depth, salinity and temperature
- Benchtop Fluorometer, chl *a* measured from three, replicate water samples taken at three depths (surface, chlorophyll max, bottom)
- TSG (thermosalinograph), measures temperature, salinity and fluorescence (in vivo chlorophyll a) along ship's track. These data are captured and paired with CUFES events/collections.

Useful in Assessments

Current SEDAR and ICCAT:

- Atlantic bluefin tuna, red snapper, king mackerel

Potential other assessments:

- vermilion snapper, gray triggerfish, select groupers, amberjacks, Gulf menhaden, mullets, drums, other tunas

Oceanographic modeling:

- Highly migratory species, estuarine-dependent offshore spawners (mullet, menhaden, drums, crab and shrimp larvae)

Strengths and Weaknesses

Strengths

- Relatively long time series
- Large spatial scale
- Multiple species sampled

Weaknesses

- Long sample processing time
- Very complex data structure
- No coverage in South Atlantic waters

Recent Developments

- genetic identification of previously unidentifiable archived SEAMAP specimens (e.g. early stage tuna and snapper larvae)
- analysis of invertebrate zooplankton fraction with a special focus on decapod crustacean larvae of SEAMAP plankton samples began in 2006 at NMFRI/ZSIOP, especially crab and shrimp larvae
- routine collection of additional samples using a 1 m MOCNESS and CUFES (Continuous Underway Fish Egg Sampler) during dedicated SEAMAP plankton surveys
- DNA based identification of fish eggs collected with CUFES (collaborations with academic researchers, F. Hernandez, USM/GCRL and J. Quattro, USC)

Future Plans/Improvements

- Establish protocols for routine use of DNA identification of eggs and larvae
- Expand sample and data collection for zooplankton (add finer mesh nets to plankton gear)
- Undertake diet analysis on larvae and investigate/describe food web characteristics
- Begin routine analysis of larval fish otoliths for FMP species to improve precision of indices
- Develop a single, web-based data entry system for use by all SEAMAP collaborators
- Establish a coherent version of SEAMAP plankton data that is taxonomically updatable
- Investigate an alternative sampling design for plankton sampling patterned after the trawl surveys design
- Increase capacity for sample analysis (sorting and identification) of both fish and invertebrate zooplankton in survey samples
- Investigate use of towed cameras during surveys for remote, optically census of fish larvae
  e.g. ISIS

NOAA FISHERIES
SEFSC

Improving The NOAA NMFS and ICCAT Atlantic Bluefin Tuna Fisheries Management Decision Support.

Years: 2008-2011, Spring
Funding source: NASA
Geographical Area: Gulf of Mexico, Western Caribbean
Objectives: Develop habitat models for larval tuna to predict areas of abundance and improve the larval index for Atlantic bluefin tuna.

Management And Conservation Of Atlantic Bluefin Tuna (*Thunnus Thynnus*) And Other Highly Migratory Fish In The Gulf Of Mexico Under IPCC Climate Change Scenarios: A Study Using Regional Climate And Habitat Models

Years: 2012-2015, Spring
Funding Source: NASA
Geographic area: Gulf of Mexico, Caribbean.
Objectives: Enhance the management of multiple important highly migratory pelagic fish species in the Gulf of Mexico and surrounding waters, with particular focus on Atlantic bluefin tuna and other highly migratory tunas and billfishes.

Collaborations

- Atlantic Oceanographic and Meteorology Laboratory
- NASA
- Instituto Nacional de Pesca - Mexico
- El Colegio de la Frontera Sur Mexico
- Instituto Español de Oceanografía Spain
- University of South Florida
- University of Miami
- ROFFS Fishing Service
- University of South Carolina

Gears

Retrieving 1-Meter MOCNESS

Deploying Bongo Nets Portside

Washing down the Nets

Collecting plankton

Spanish or subsurface neuston
Towed from the surface to 10 meters

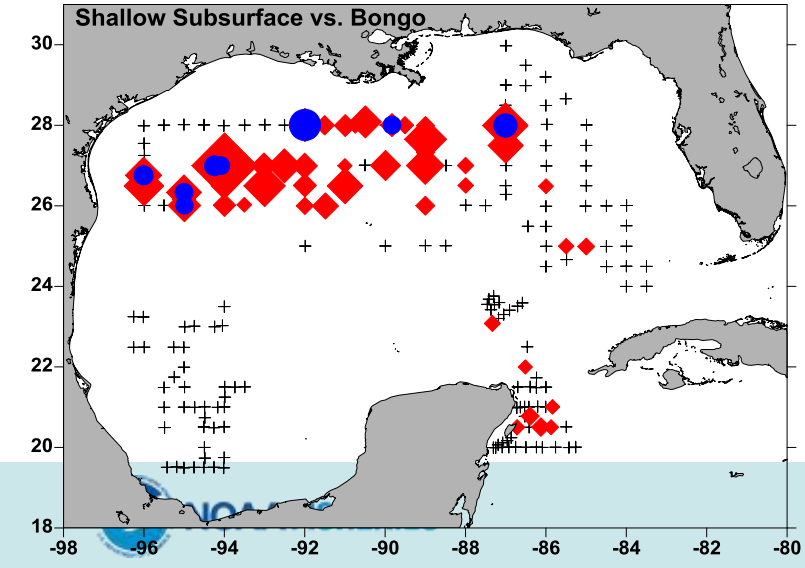
Larval bluefin tuna gear selectivity and habitat modeling, Gulf of Mexico and western Caribbean

- A new plankton sampling method trialed in 2009 has been more widely applied during 2010 – 2012

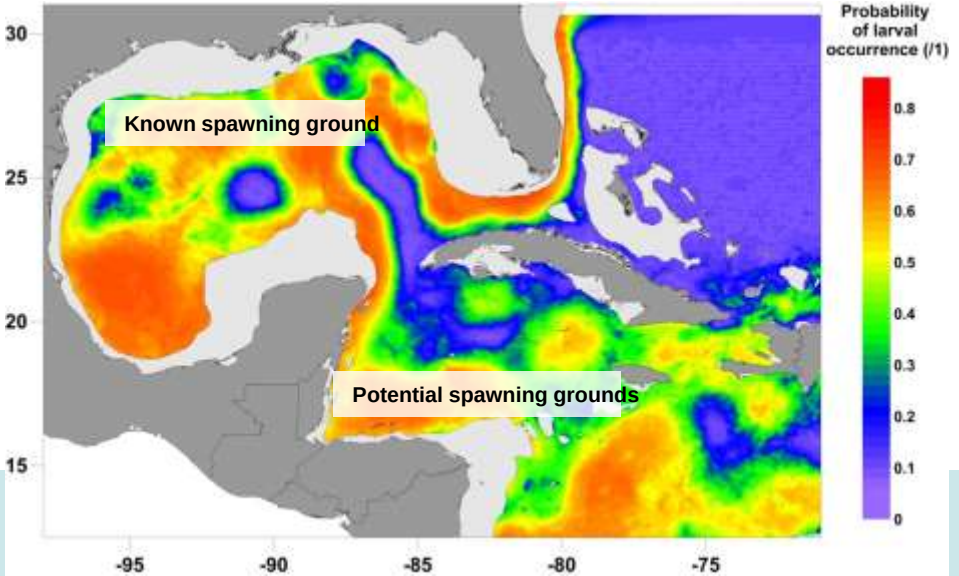
- This gear has a larger mouth, coarser mesh and fishes shallower depths (0→ 10m) than traditional bongo nets
- Larval occurrences and abundances are significantly higher with this new gear
- This has allowed us to develop more accurate models of potential spawning grounds, and may lead to the development of an improved larval index
- An improved index would allow the more accurate assessment of adult spawning stock biomass in the Gulf of Mexico

The new shallow subsurface net

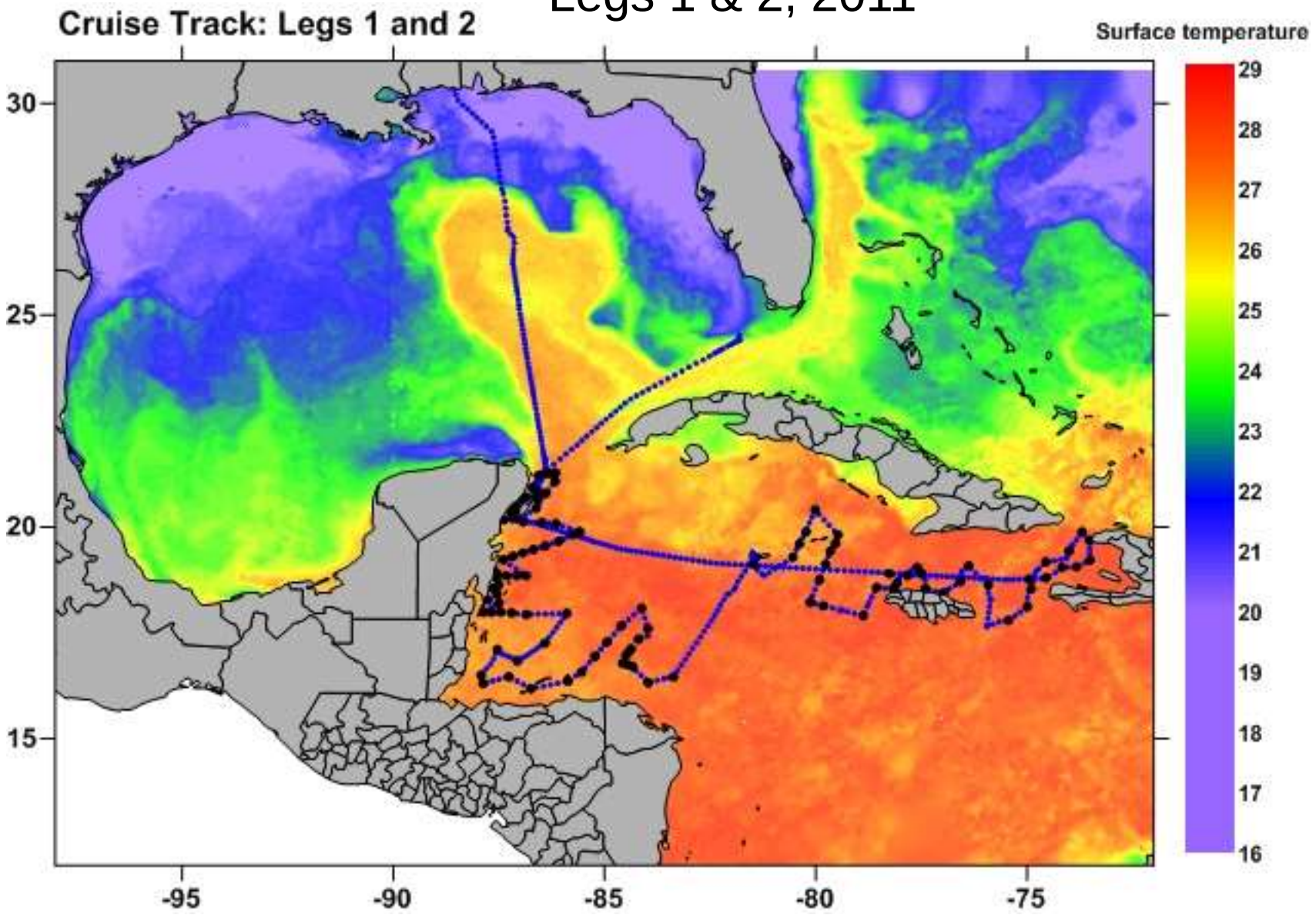
Catches from bongo (blue) and subsurface (red) tows, 2010



Experimental model of larval occurrence from new shallow subsurface gear



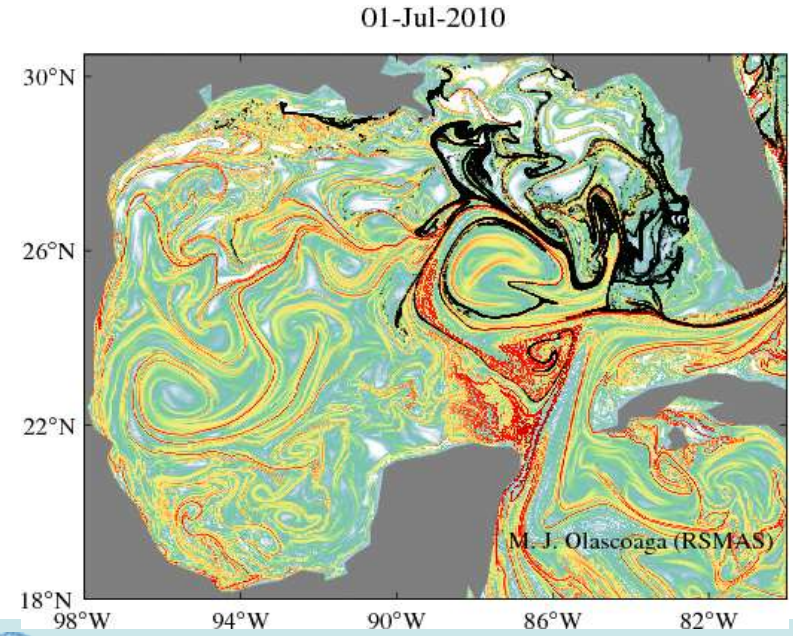
Legs 1 & 2, 2011


Cruise Track: Legs 1 and 2
Surface temperature
29
28
27
26
25
24
23
22
21
20
19
18
17
16
30
25
20
15
-95
-90
-85
-80
-75

2013 spring larval bluefin tuna cruise

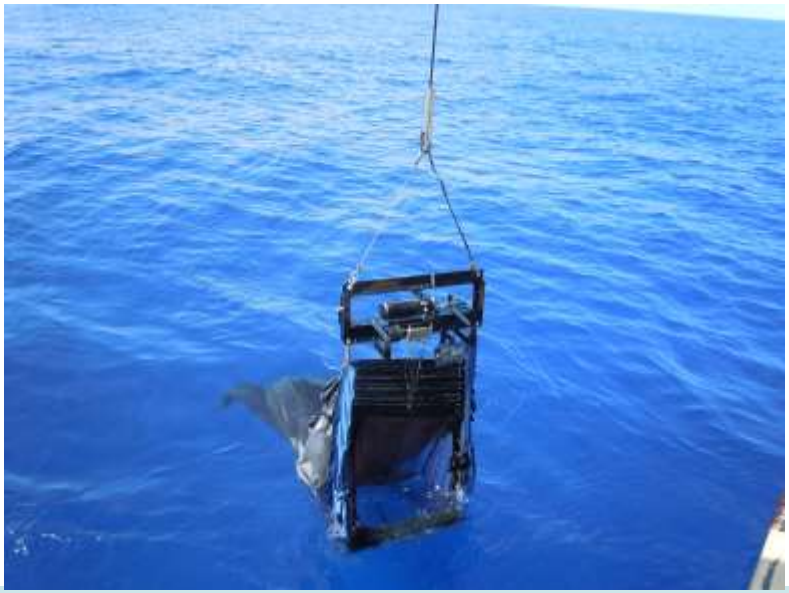
- In 2013 we will add an additional research objective aimed at understanding the role of Lagrangian Coherent Structures on tuna spawning and larval distributions. These structures form a barrier to exchange between water masses and can be regarded as a material line such that fluid particles straddling it either diverge or converge in forward time. LCSs thus delineate the boundary between fluid domains with quite distinct advection characteristics
- We will samples across and along these structures using discrete depth sampling gear to characterize the larval fish assemblages associated with these structures.

LCS structure in the Gulf of Mexico 2010,



Discrete depth sampling gear (MOCNESS)

Samples will be collected in 10 meter bins from 50 meters to the surface



Useful in Assessments (SEDAR, ICCAT, Ecosystem assessment, and climate change impacts

Future Directions – larval ecology, food web dynamics using isotope signatures, larval growth dynamics in relation to mesoscale oceanographic features, comparative ecosystem studies climate impacts on fisheries

SEFSC Longline Surveys

Survey	Description	Area of Operation	Frequency
Longline Shark/Red Snapper Survey	Surveys shark and reef fish species. Data are collected for the biology, distribution, movements, stock structure. Surveys involve catching sharks on longline gear, measuring, attaching various tags, and releasing them alive. Fin fish are sampled for hardparts to produce biological information.	Cape Hatteras, North Carolina to Cape Canaveral, FL and into the Gulf of Mexico to Brownsville, TX between bottom depths 9 - 366 m in the Gulf of Mexico and 9 - 183 m in the Atlantic.	Annual, Jul-Sep
SEAMAP-GOM Inshore Finfish Bottom Longline Survey (Alabama)	Surveys inshore shark and fish species. Data are collected on biology, distribution, movements, and stock structure. Fish are sampled for hardparts to produce biological information.	One location in Mississippi Sound, another in Mobile Bay, and two south of Dauphin Island, AL	Annual, Mar-Oct
SEAMAP-GOM Coastal Inshore Bottom Longline Shark Survey (Mississippi)	Surveys inshore shark and fish species. Data are collected on the biology, distribution, movements, and stock structure. Fish are sampled for hardparts to produce biological information.	Mississippi Sound and south of Mississippi barrier islands – a 342 km^2 area extending from West Cat Island to East Petit Bois Island and 6.4 km to the north and south of the islands.	Annual, one depth stratified (0-5m, 5-10m, and 10-20m) station was randomly chosen within each area monthly during the March to October sampling period. Six stations are performed each month.
SEAMAP-GOM Finfish Bottom Longline Survey (Louisiana)	Surveys inshore shark and fish species. Data are collected on the biology, distribution, movements, and stock structure. Fish are sampled for hardparts to produce biological information.	Off Louisiana west of the Mississippi river in state and federal waters. Sampling depths range from 12 to 600 ft.	Annual, Mar-Oct
SEAMAP-GOM Finfish Bottom Longline Survey (Texas)	Surveys inshore shark and fish species. Data are collected on the biology, distribution, movements, and stock structure. Fish are sampled for hardparts to produce biological information.	Two areas within 15 miles of Aransas Pass and Bolivar Roads Ship Channel, exclusively in state waters (up to nine nautical miles offshore). Sampling depths range from 10 to 65 ft.	Annual, Jun-Sep
Pelagic Longline	Longline survey of shark and fish species. Data are collected on biology, distribution, movements, stock structure. Random survey site selection based on significant oceanic (Gulf Stream or loop currents), or bathymetric features (continental shelf edge).	Cape Hatteras, NC, to Cape Canaveral, FL, and in the U.S. Gulf of Mexico	Bi-annual, March - May

NOAA FISHERIES SEFSC

Fisheries Independent Bottom Longline Surveys

1995 – 2012; 32 Surveys

U.S. GOM and Atlantic Coast

(Mexico and Cuba GOM, Cuba and Navassa Island Caribbean)

- **OBJECTIVES**
  - **Relative abundance and interannual variability**
  - **Control potential sources of survey bias**
  - **Repeatable survey**
  - **Standardized survey design and gear**
  - **Random station selection**
  - **Biological sampling and tagging**
  - **Associated environmental data**
  - **1999 objectives expanded to include red snapper**

Collaborations

- Gulf of Mexico SEAMAP Coastal Longline (follows NMFS protocols)
  - Alabama
  - Mississippi
  - Louisiana
  - Texas

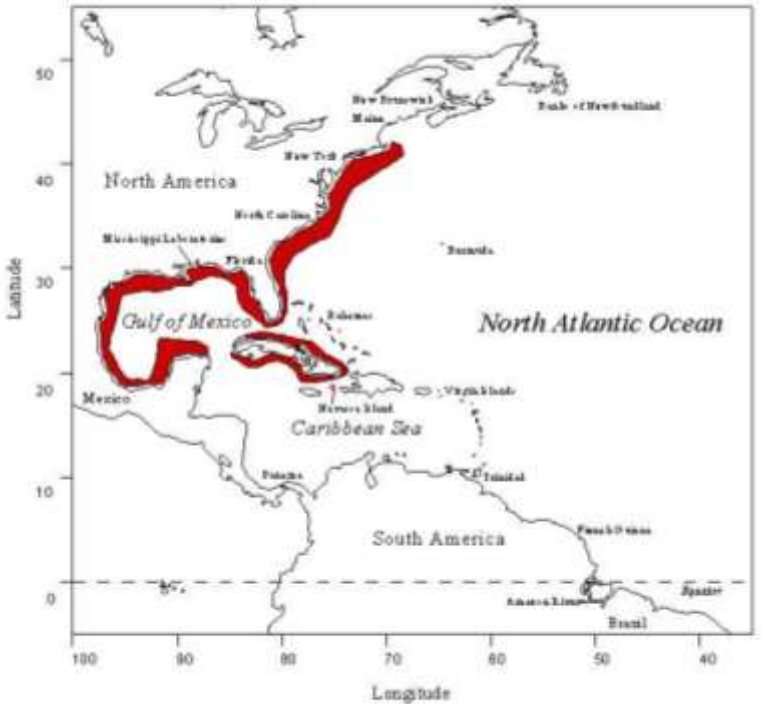
SEAMAP CONTRIBUTION

AGENCY	TIME SERIES	SURVEY MONTHS	# SETS	# CAPTURES
Alabama - DISL	2010 - 2012	Mar. – Oct.	74	1,015
Mississippi - GCRL	2007 - 2012	Mar. – Oct.	339	4,986
Louisiana - LWF	2011 - 2012	Mar. – Oct.	109	3,031
Texas - TPW	2010 2011, 2012	Mar. – Sept. Jun. - Sept	61	855
Total			583	9,887

Summary

MS LABS CONTRIBUTION								
TIME SERIES	# SURVEYS	# SETS	# CAPTURES	TAGS	FIN CLIPS	OTOLITHS	GONADS	# TAXA
1995 - 2012	32	4,232	38,340	7,575	5,969	2,328	2,075	152

- 60 Days At Sea Allocation
  - July, August, September
- NOAA Ships
- Survey Depth Range
  - 9 – 183 m Atlantic Ocean (primarily south of Cape Hatteras)
  - 9 – 366 m Gulf of Mexico (1997, 1998 Mexico, 1998 Cuba)
- Survey Design (proportional allocation of stations based on continental shelf width for 1° of latitude or longitude)
  - Atlantic; 9 – 55 m 60%, 55 – 183 m 40%
  - GOM; 9 – 55 m 50%:, 55 – 183 m 40%, 183 – 366 m 10%



GEAR

BOTTOM LONGLINE

- 1.0 nautical mile of 4.0 mm monofilament (454 kg test)
- 3.0 m gangions 3.0 mm diameter monofilament (318 kg test)
- #3/0 J hooks (1995 – 1999); hook comparison between #3/0 J hooks and #15/0 circle hooks
- 1999 and 2000
- #15/0 non-offset circle hooks (2000 to present)
- 5 kg bottom weights; start, mid and end set.
- Radar reflecting hyflyer buoys at distal ends
- Bait – Atlantic mackerel (*Scomber scombrus)*
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer

BIOLOGICAL SAMPLING

- DNA (fin clips/forensics)
- Tissue
- Blood
- Otoliths
- Gonads
- Parasites

TAGGING

- NMFS Panama City, Florida Laboratory, small and large coastal sharks.
- NMFS Narragansett, Rhode Island, large coastal sharks.
- Mote Marine Laboratory tagging program, large and small coastal sharks.
- Satellite tagging with Gulf Coast Research Laboratory, University of Southern - Mississippi and NMFS Panama City, Florida in conjunction with Mote Marine Laboratory, Sarasota, Florida.
- Cooperative tagging program with Dauphin Island Sea Lab, University of South Alabama.

DATA COLLECTION ADVANCES

- On-deck weatherproof laptops
- Per-hook effort
- Gear status
- Bite-offs
- Catch/no catch
- Bait status
- Gear configuration

Useful in Assessments

- Large coastal sharks
  - Dusky shark
  - Sandbar shark
- Small coastal sharks
  - Blacknose shark
  - Blacktip Shark
  - Atlantic Sharpnose shark
- Red Grouper
- Red Snapper
- Tilefish
- Yellowedge grouper

IMPROVEMENTS and CHALLENGES

- Data Quality Improvements
  - Support species verifications via photographic documentation and DNA sequencing
  - Continued development of data editing routines
  - Disseminate data editing routines to collaborators

- Challenges
  - Develop a U.S. southeast Atlantic SEAMAP longline survey based on NMFS protocols
  - Adapt to changing NOAA/NMFS management objectives
  - Incorporate gear selectivity experiments (e.g., hook selectivity)
  - Conduct surveys that address potential seasonality issues
  - Adapt larger-sized NOAA ships to suit survey objectives

NOAA FISHERIES
SEFSC

Fisheries Independent Pelagic Longline Pilot Study Surveys

2004, 2005, and 2006

U.S. Eastern GOM and Atlantic Coast

- Pelagic longline gear
- Random station selection
- Repeatable survey
- Control potential sources of bias
- Species distributions
- Biological sampling and tagging
- Associated environmental data

Summary

PELAGIC LONGLINE PILOT STUDY SURVEYS

- U.S. Atlantic Coast (2004 and 2006)
- U.S. Gulf of Mexico (2005)
- 340 h effort
- 9316 hooks
- 92 sea days

CATCH SUMMARY

- 605 Captures
- 269 Tags Deployed
- 133 Fin Clips for DNA
- 22 Gonad
- 16 Otoliths

Gear

PELAGIC LONGLINE GEAR

- 5.0 nautical mile of 4.0 mm monofilament (454 kg test)
- 22 m gangions 2.0 mm diameter monofilament (181 kg test), steel leaders
- - #18/0 non-offset steel circle hooks; 50/set, 2 hooks between bullet floats (50/set)
- 5 kg down weights; start, mid and end set.
- Radar reflecting hyflyer buoys at distal ends and midpoint
- Bait – Atlantic mackerel (*Scomber scombrus)*
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer

Bottom and Pelagic Longline Strengths and Weaknesses

Strengths

- Geographically broad based across management critical depth strata for key species.
- The surveys are non-targeted with regards to species; development of multiple annual indexes.
- Well-defined survey protocols provide a format for project expansion by non-NMFS entities.
- Customized data software allows for fine-scale details (catch and gear).

Weaknesses

- Synoptic issues.
- Pelagic longline projects need to be a consistent annual survey component.
- Gear selectivity issues potentially limit broader management applicability.

Congressional Supplemental Sampling Program

NOAA FISHERIES

- FMP Species:
  - Increase sample size and precision of all estimates
  - Age-specific indices of abundance, growth, & fecundity
  - Gear & hook selectivity
- Habitats:
  - Map bottom topography using side scan sonar
  - Expand universe of reef habitats for annual reef fish surveys

Summary Information

Time series: 2011

Coordinating agency: SEAMAP-Gulf of Mexico

Area of focus: Continental shelf and shelf-edge banks

Dry Tortugas to US-Mexico Border

Depths: ~ 10-150m

Duration: 712 days at sea

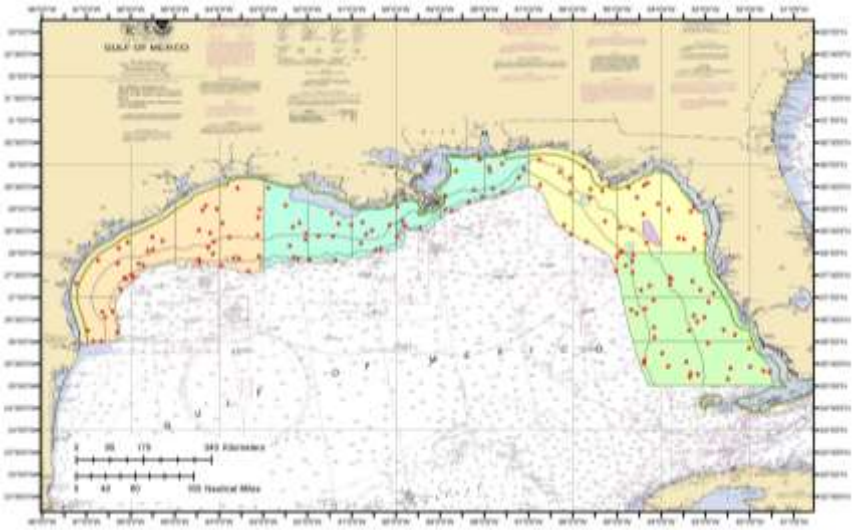
Platforms: Chartered commercial fishing vessels

Survey Design

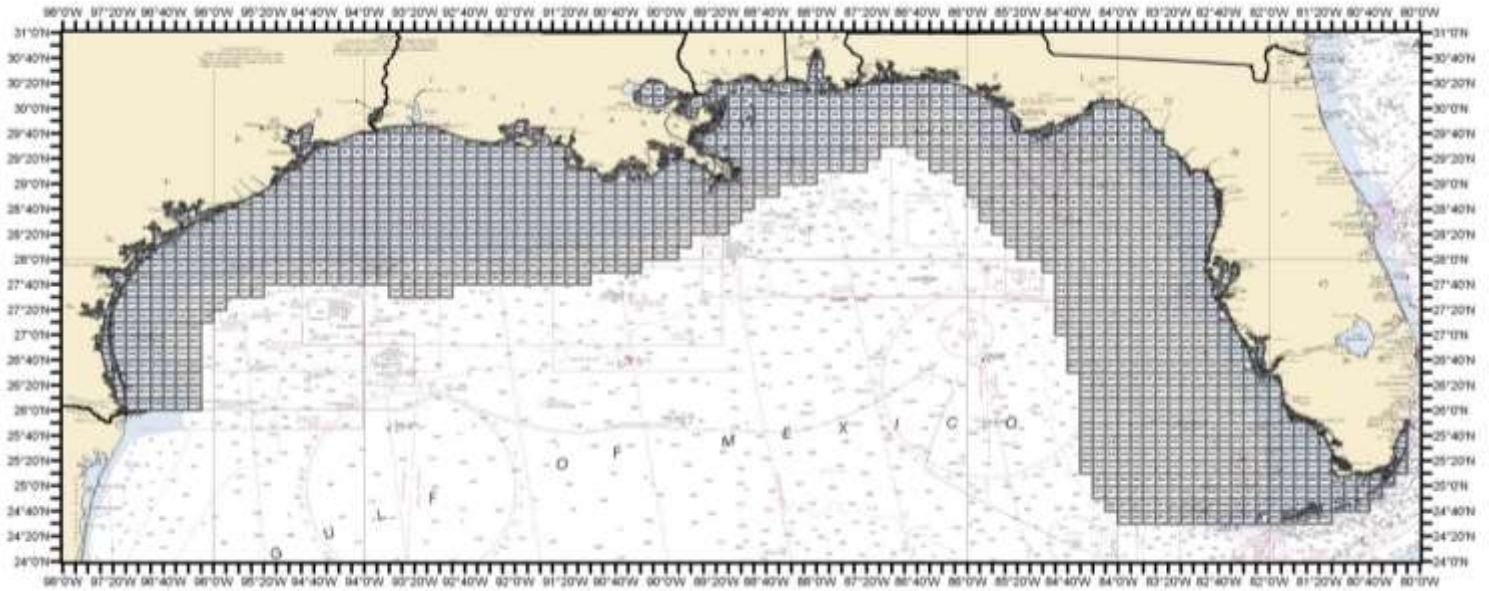
Paired sampling: Apr 7 – June 29
NMFS bottom longline design

Independent sampling: July 31-Oct 16
NMFS bottom longline design
NMFS reef fish survey design for vertical line

Paired sampling & Longline independent



Vertical line independent



Survey Design

Paired sampling: Intent was to evaluate gear selectivity

Independent sampling: Changed to independent because of low catch on vertical line when paired

Paired sampling

- Followed NMFS bottom longline design
- Longline sites weighted on 3 depth strata
- NMFS protocols for bottom longline sets followed exactly
- 5 bandit reel sample sites randomly selected at least 0.1 - 0.5 nm from longline sample site
- 3 bandit reels fished simultaneously for 5 min at each site
- Each reel had 10 Mustad circle hooks (either all 8/0, 11/0 or 15/0)
- Hooks baited with Atlantic mackerel (*Scomber scomberus*) cut to match the size of each hook

Independent vertical line

- Out of 158 possible grids a total of 82 grids were selected to fish.
- Grids were selected using stratified randomly sampling design.
- Identical to reef fish video, weighted by stratum and reef area

Independent longline

- Continued to followed protocols outlined in the paired sampling program
- Identical to NMFS bottom longline annual survey

Survey gears

Bottom longline

- NMFS protocols
- Low relief, muddy bottoms

Bandit reel

- High relief, reef habitats
- Initially paired with longline
- Independent sampling last half

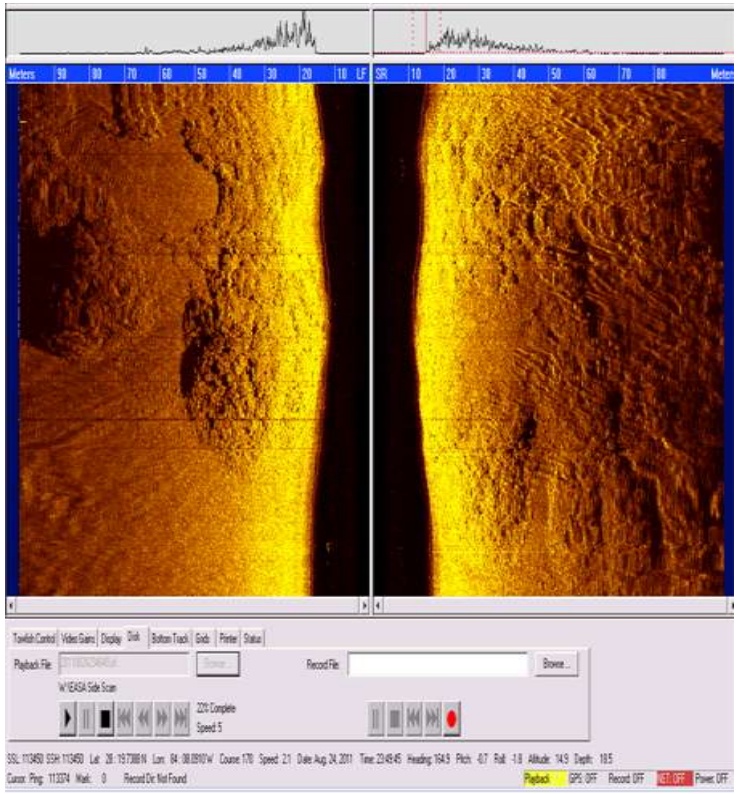
Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer. CTD cast deployed during drift, surface to maximum depth

Acoustic Gears

Edgetech side-scan sonar

- Reef delineation
- Habitat characterization
- Site selection during independent sampling when randomly selected block reef content was unknown

- Selected 4 random transect lines going N-S or E-W (determined by contour & sea state)
- Surveyed transect with side scan sonar
- Side scanning images were used to select possible reef habitat
- 10 bandit reel sites sampled per day
  - 8 possible reef sites
  - 2 possible non-reef sites
- Independent sampling when side scan was not possible



Assessment support

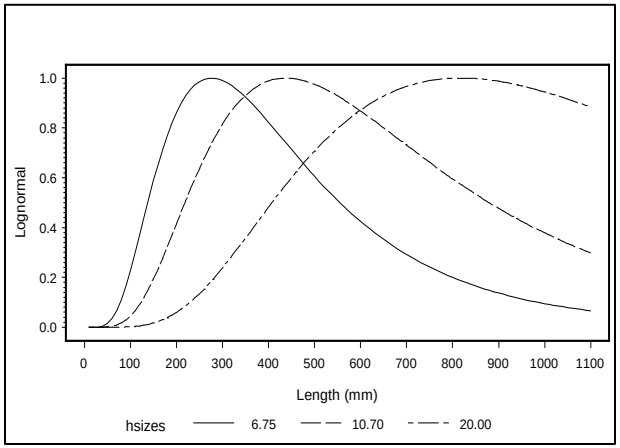
SEDAR and indices

SEDAR 31 (2012) red snapper

- **Improved precision of bottom longline index (DW-17)**
- **Hook selectivity (AW contribution)**

SEDAR 33 (2013) gag grouper

SEDAR 33 (2013) amberjack



Adam G. Pollack, Matthew D. Campbell, and William B. Driggers. 2013. Estimation of hook selectivity on red snapper (*Lutjanus campechanus*) during a fishery independent survey of natural reefs in the Gulf of Mexico. SEDAR assessment workshop contribution.

Collaborations

Vertical line

LDWF

FWRI

Alabama DCNR

USA – Dauphin Island Sea Lab

TPWD

University of Southern Mississippi

Side-scan sonar

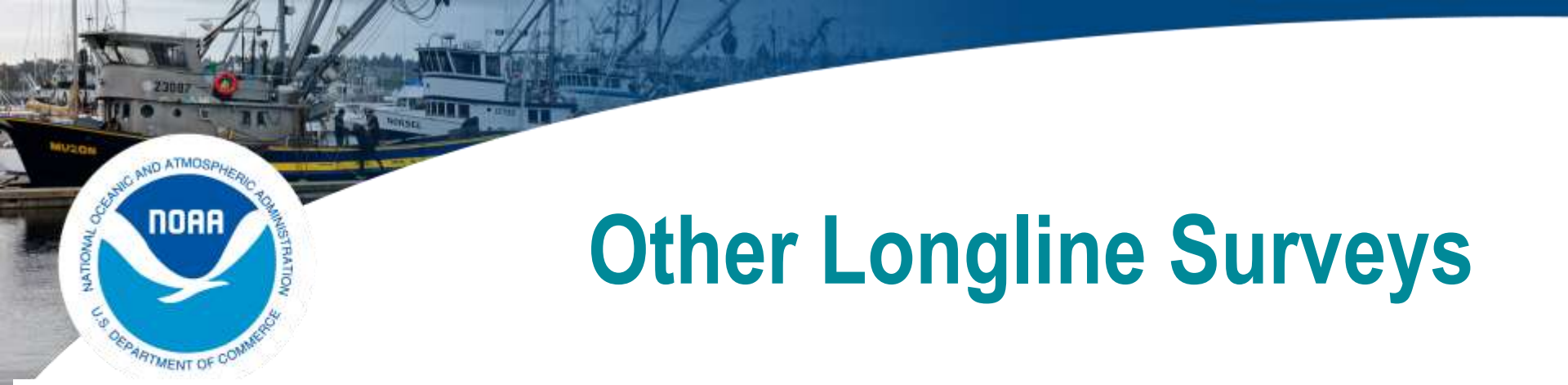
University of South Florida

FWRI

NMFS-PC

TAMU-CC

NOS - Beaufort



Other Longline Surveys

Survey	Description	Area of Operation	Frequency
MARMAP Reef Fish Bottom Longline Survey	Bottom long line survey to monitor relative abundance and life history of golden tilefish and other species that occur over soft (muddy) bottom habitat in areas around 100 fathom depths.	South Atlantic Bight (between 27°N and 34°N, but mostly off GA and SC). Sampling occurs in federal waters. Depths from about 500- 860 ft.	Annual, Aug-Oct
SEAMAP South Atlantic GA Red Drum Longline Survey	Surveys the adult red drum population for abundance, distribution and age composition. Tagging provides data on migration and stock identification. A sub-sample of red drum is collected for biological information including age, reproductive activity, genetic composition of the stock, and stomach content analysis.	State and federal waters off the coast of Georgia and northeastern Florida in an area bounded by 32°05'N latitude to the north, 29°20'N latitude to the south, 80°30'W longitude to the east, and the coastline to the west.	Annual, Apr-Dec
SEAMAP South Atlantic NC Red Drum Longline Survey	Surveys adult red drum population for abundance, distribution and age composition. Tagging provides data on migration and stock identification. A sub-sample of red drum is collected for biological information including age, reproductive activity, genetic composition of the stock, and stomach content analysis.	Pamlico Sound or in near-shore waters of Ocrocoke Inlet, NC	Annual Jul-Oct
SEAMAP South Atlantic SC Red Drum Longline Survey	Surveys adult red drum population for abundance, distribution and age composition. Tagging provides data on migration and stock identification. A sub-sample of red drum is collected for biological information including age, reproductive activity, genetic composition of the stock, and stomach content analysis.	Inside estuaries out to 10 miles, in four core areas: Winyah Bay, Charleston Harbor, St. Helena Sound, and Port Royal Sound, SC.	Annual, Aug-Dec

Video, Trap, ROV, and Vertical Line Surveys of the SEFSC

Survey	Description	Area of Operation	Frequency
SEAMAP Reef Fish Survey	Surveys reef fish species. Data are also collected for biology, distribution, and stock structure. Reef fish are sampled for hardparts to produce biological information.	Brownsville, Texas to Key West, FL, in depths of 15-500 ft.	Annual, Apr-Jul
Gulf of Mexico MPA Survey	The Madison-Swanson and Steamboat Lumps marine reserves on the West Florida Shelf protect spawning aggregations of gag grouper. Surveys habitat and species assemblages and tracks changes in reef fish abundance and distribution.	Madison-Swanson and Steamboat Lumps marine reserves on the West Florida Shelf	Annual, Feb-Mar
Panama City Laboratory ROV Reef Fish Survey	Surveys temporal and spatial patterns in abundance of exploited and non-exploited reef fishes, community structure, habitat associations, and size structure on a cross-shelf series of low relief (0.2-1.5 m) and high relief (up to 10 m) rocky reefs during daytime hours.	NE Gulf of Mexico, inner to mid-shelf off Panama City, FL, 25-50 m depths	Annual, Oct-Nov
Panama City Laboratory Trap/Video Reef Fish Survey	Survey to produce age-based annual indices of abundance of reef fishes. Sampling occurs on rocky reefs and live bottom in inner and mid-shelf waters (8-50m) during daytime hours using a stationary camera array at every site, followed with a chevron trap at every other site.	Destin to Cedar Key, FL	Annual, May-Sep
SEAMAP-GOM Finfish Vertical Line Survey (Alabama)	Surveys abundance and distribution of reef fish in Alabama waters.	State and federal waters off Alabama. Stations are sampled during daylight hours. Sampling depths 60 to 500 ft.	Annual, Mar-Apr, May-Jun, and Sep-Oct
SEAMAP-GOM Finfish Vertical Line Survey (Louisiana)	Surveys abundance and distribution of reef fish in Louisiana waters west of the Mississippi River.	State and federal waters west of the Mississippi river, across three depth strata (60-120 ft, 120-180 ft, and 180-360 ft). Stations are sampled during daylight hours. Sampling depths 60 to 360 ft.	Annual, Quarterly
SEAMAP-MARFIM Reef Fish Monitoring (Florida)	Survey monitors relative indices of abundance of reef fishes to determine patterns in community structure, and habitat associations, along with regional catch, recruitment, demographics, and distribution.	West FL shelf from 26 degrees N to Dry Tortugas, FL.	Annual, July-Sept
MARMAP / SEAMAP-SA Reef Fish Survey	Surveys species abundance, distribution, and habitat in the South Atlantic Bight region. Multiple gears are used to obtain life history samples of reef fishes (mostly species in the SAFMC snapper-grouper management complex).	South Atlantic Bight (between 27°N and 34°N)	Annual, April-Oct
SouthEast Fishery-Independent Survey (SEFIS)	Surveys reef fish species in South Atlantic waters using underwater video and chevron fish traps. SEFIS works cooperatively with MARMAP/SEAMAP to increase sample sizes and improve the spatial coverage.	Cape Hatteras, NC, to St. Lucie Inlet, FL	Annual, Apr-Oct

SEAMAP-Gulf of Mexico Reef Fish Video Survey

NOAA FISHERIES

Objectives

- Survey reef fish species associated with hard bottom, high relief, topographic features of the Gulf of Mexico
- Provide indices of relative abundance for use in stock assessments

Summary Information

Time series: 1992-1997, 2001-2002, and 2004-present

Coordinating agency: SEAMAP-Gulf of Mexico

Area of focus: Continental shelf and shelf-edge banks

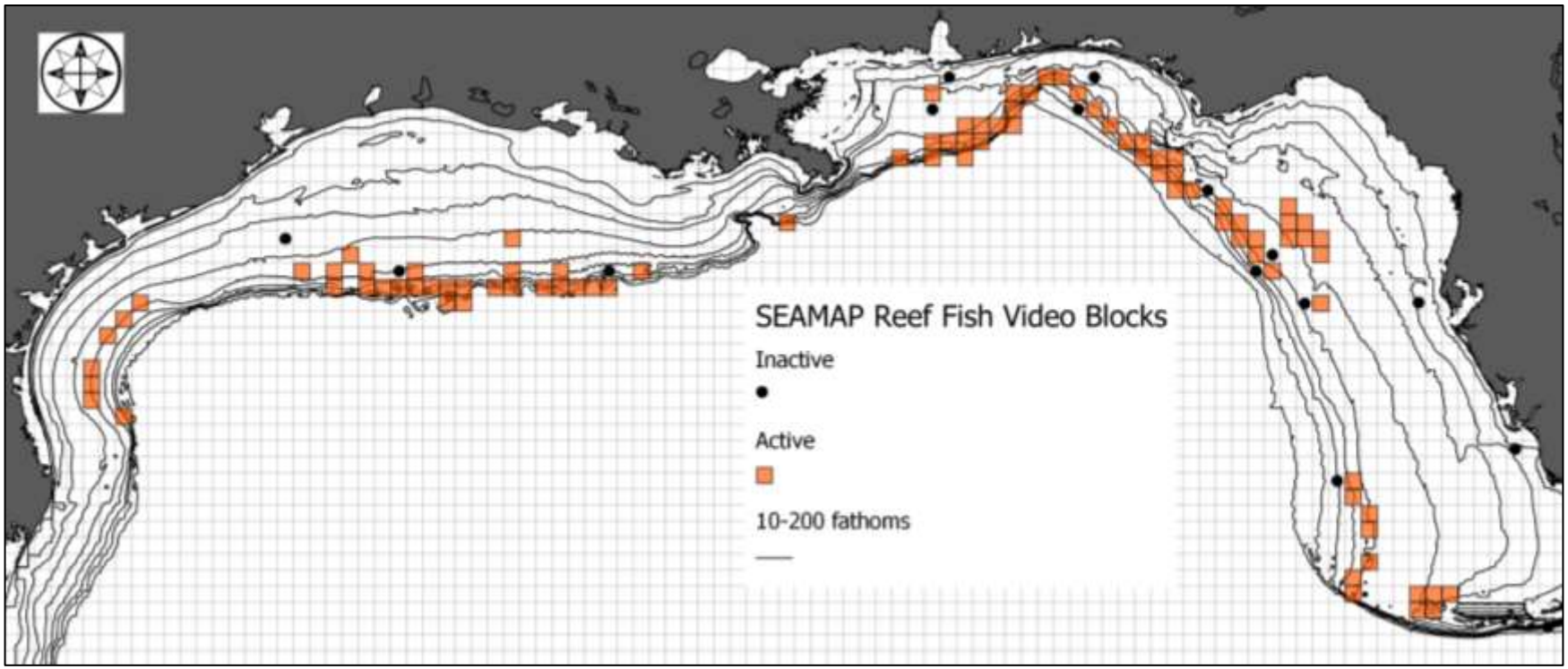
Dry Tortugas to US-Mexico Border

Depths: ~ 40-150m

Duration: 60 days at sea

Platforms: NOAA ships and NMFS small boats

Survey Design



- Two stage - random stratified sampling design
- Weighted by area of reef in a block, 7 total strata
- Blocks with larger amount of reef area are weighted higher than those containing less reef area
- 1st stage 10' lat by 10' long blocks
- 2nd stage sites within blocks gridded to 0.1 nm

- ~400 total sites sampled per year with video
- ~200 total sites sampled per year with vertical gear
- Acoustic biomass at all sites
- Mapping opportunistically to expand universe

Survey gears

- Video and still cameras have been used and have evolved with time
- Current: 4 orthogonally placed stereo cameras with HD video
- Maximum depth 150 m

- Chevron fish traps & vertical line – hard parts and reproductive organs

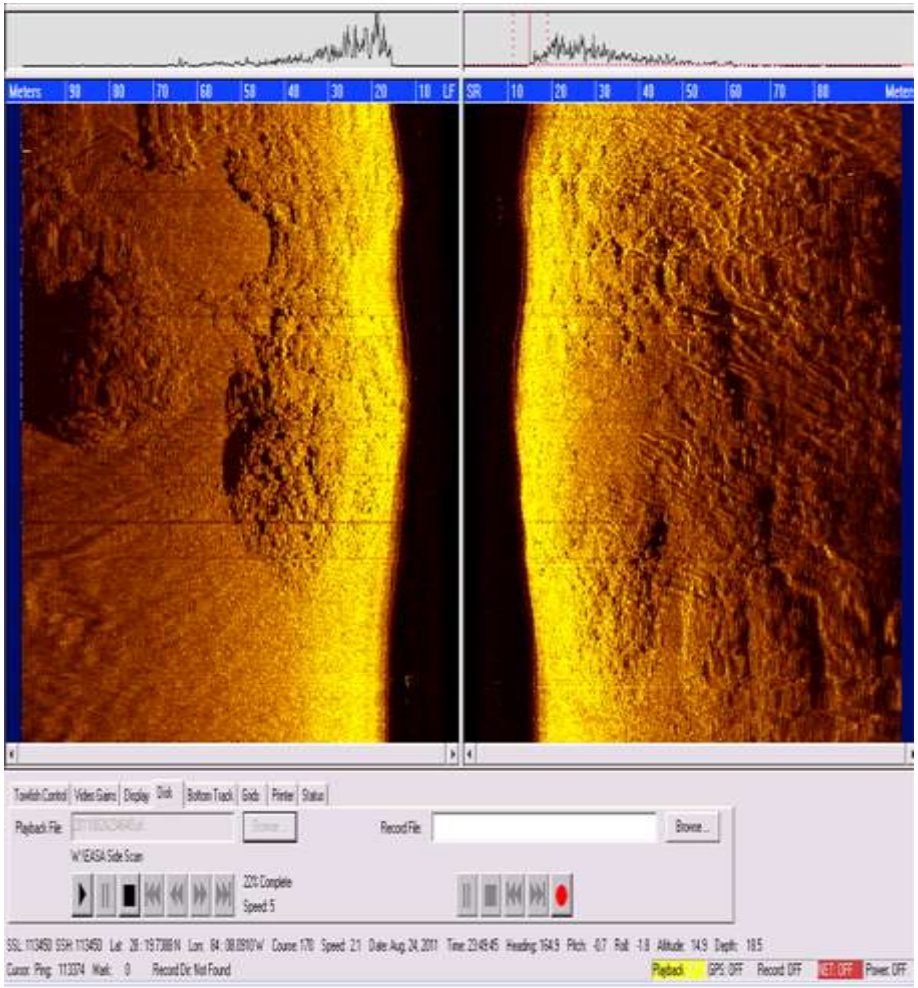
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer. CTD cast deployed during drift, surface to maximum depth.

Acoustic Gears

ME-70 multi-beam
EK-60 split-beam
Edgetech side-scan sonar

- Essential to survey improvement
- Expansion of block universe
- Reef delineation
- Habitat characterization
- AUV recently acquired

- Acoustic biomass data collected continously. ME-70 & EK-60
- Acoustic biomass protocols and processing still being refined



Video read method
Abundance and min-count

- One of four tapes from a station randomly selected for viewing
- Videos with obstructed views from physical objects, dark turbid water, and camera malfunctions are excluded from analysis
- Videos are viewed for twenty minutes starting from the time the view clears from suspended sediment
- Viewers identify, and enumerate all FMP species and estimate abundance using the min-count procedure
- Min-count is defined as the maximum number of individuals of one species that occur simultaneously on the video at one moment in time
- Min-count avoids problems of independence and double counting of fish
- Lengths of fish are only measured at point of min-count

Assessment support

SEDAR and indices

SEDAR 7 (2004) red snapper.
SEDAR 9 (2005) gray triggerfish.
SEDAR 9 (2005) amberjack.
SEDAR 9 (2005) vermillion snapper.
SEDAR 10 (2006) gag grouper
SEDAR 12 (2006) red grouper.
Report to Gulf Council (2008) update assessment of gag grouper
SEDAR 19 (2010) black grouper.
SEDAR 31 (2012) red snapper
SEDAR 33 (2013) gag grouper
SEDAR 33 (2013) amberjack

Survey future

- 2013 multi-beam mapping effort scaled up to a daily effort
- ME70 data processing coming online after 3-4 years of work
- Automated underwater vehicle (AUV) was purchased and should increase the efficiency of the mapping effort (side scan). 2014 and beyond
- 2014: Next generation stereo cameras will come online
- Wider viewing angle allowing for fish measurements (VMS) at greater distances
- Begin deep-water, low-light camera development
- Exploration of the use of DIDSON technology to assist in turbid and low-light environments
- Continued streamlining habitat classification system with CMECS
- Continue partnerships with west Florida Shelf groups (NMFS-PC and FWRI)
- Build similar partnerships with other state groups in the western GOM

Collaborations

Reef fish video partners

West Florida Shelf Coordination Group

NMFS-PC

FWRI

Vertical line

LDWF

FWRI

Alabama DCNR

USA – Dauphin Island Sea Lab

TPWD

University of Southern Mississippi

Multibeam sonar

University of South Florida

FWRI

NMFS-PC

TAMU-CC

NOS - Beaufort

MPA
Reef Fish Video Survey

NOAA FISHERIES

Objectives

- Survey reef fish species associated with Madison-Swanson and Steamboat Lumps Marine Protected Areas
- Provide information on spawning aggregations of gag grouper (*Mycteroperca microlepis*) within MPAs

Summary Information

Time series: 2001 - 2010, 2012 - present

Coordinating agency: Gulf of Mexico Fishery Management Council

Area of focus: Marine protected areas in the eastern Gulf of Mexico

Region: Madison-Swanson and Steamboat Lumps MPAs

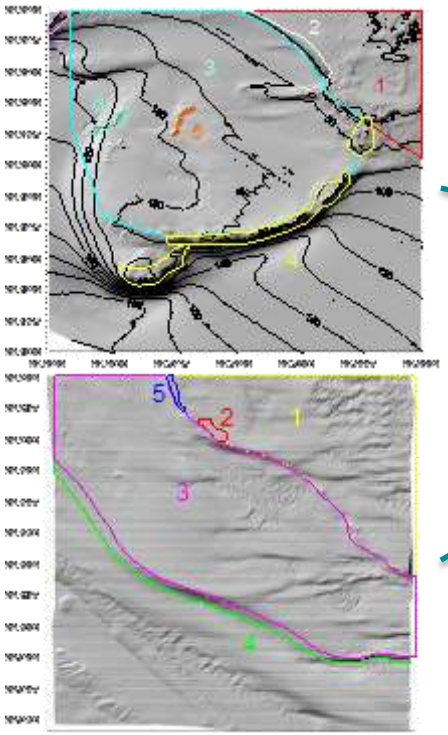
Depths: ~ 50 - 150m

Season: winter (Feb-April) to capture grouper spawning activity

Duration: 10-20 days at sea, weather critical

Platforms: NMFS small boats

Survey Design



- A stratified random design was employed to select sample sites.
- Strata were defined by area encompassed by significant topographic features within the MPA
- MS strata (1=northeast, 2= ridge, 3=central, 4=pinnacles, 5=mounds
- SL strata (1=northeast, 2=pits, 3=central, 4=paleo-shoreline, 5=ridge
- ~140 total sites selected per year
- ~70-90 total sites sampled per year with camera gear
- Heavily dependent on winter weather

Survey gears

- Video and still cameras have been used and have evolved with time
- Current: 4 orthogonally placed stereo cameras with HD video
- Maximum depth 150 m

- Chevron fish traps & vertical line – hard parts and reproductive organs
- Only in reference areas outside of the MPAs

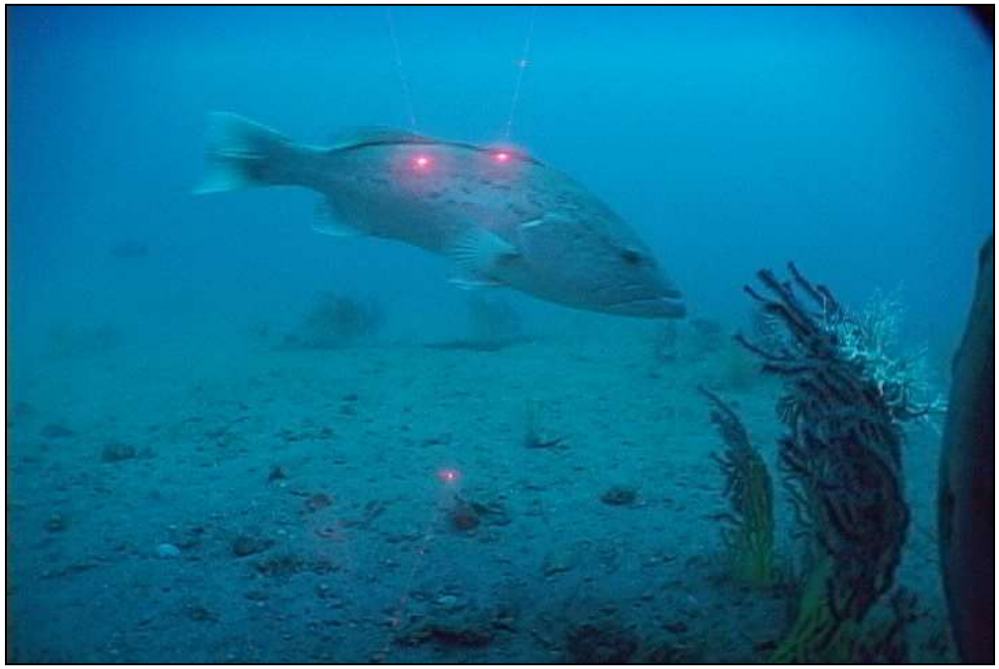
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer. CTD cast deployed during drift, surface to maximum depth.

Video read method
Abundance and min-count

- One of four tapes from a station randomly selected for viewing
- Videos with obstructed views from physical objects, dark turbid water, and camera malfunctions are excluded from analysis
- Videos are viewed for twenty minutes starting from the time the view clears from suspended sediment
- Viewers identify, and enumerate all FMP species and estimate abundance using the min-count procedure
- Min-count is defined as the maximum number of individuals of one species that occur simultaneously on the video at one moment in time
- Min-count avoids problems of independence and double counting of fish
- Lengths of fish are only measured at point of min-count

Use in Assessments

Several reports concerning reef fish stocks (e.g. gag grouper) in MPAs have been provided to the GMFMC



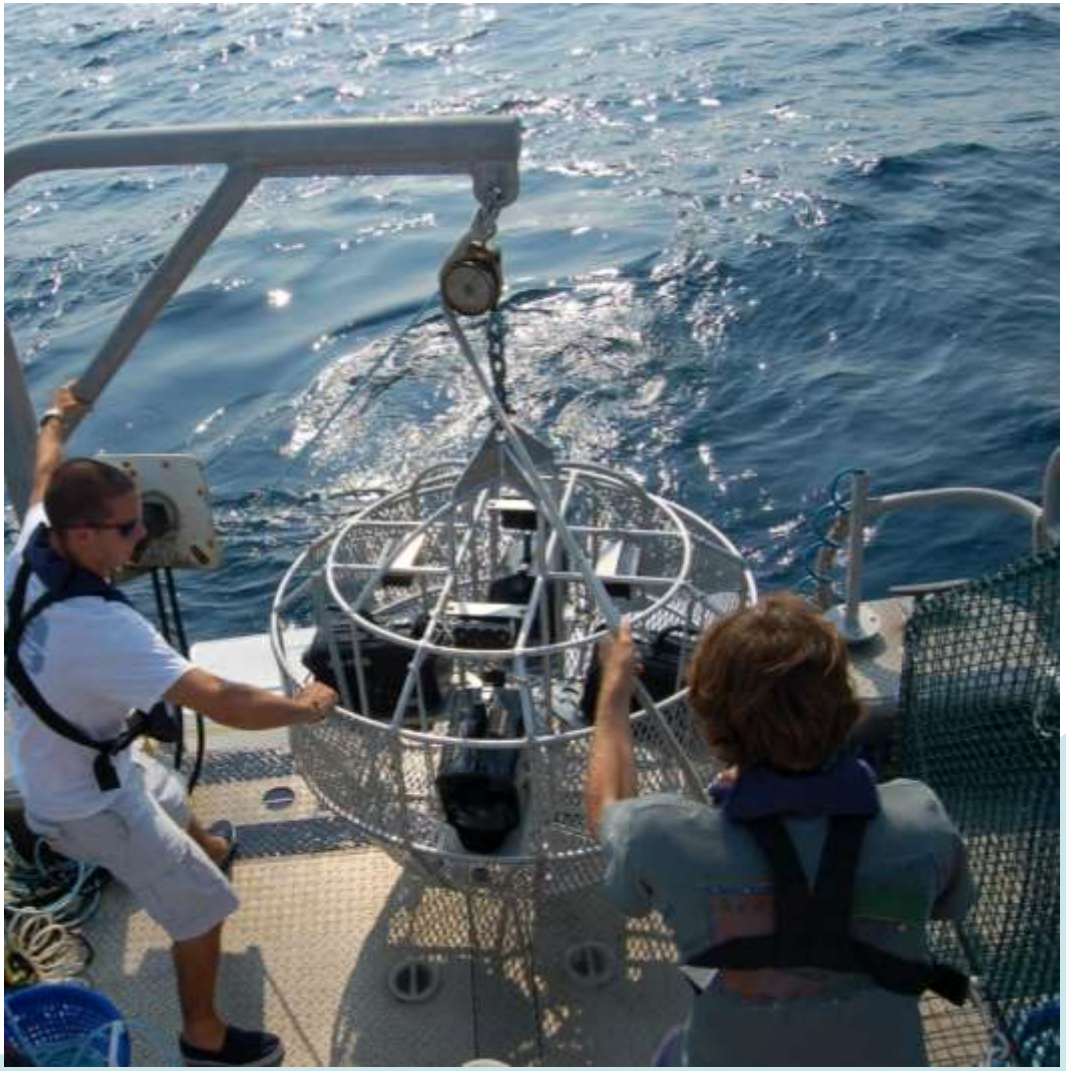
Survey future

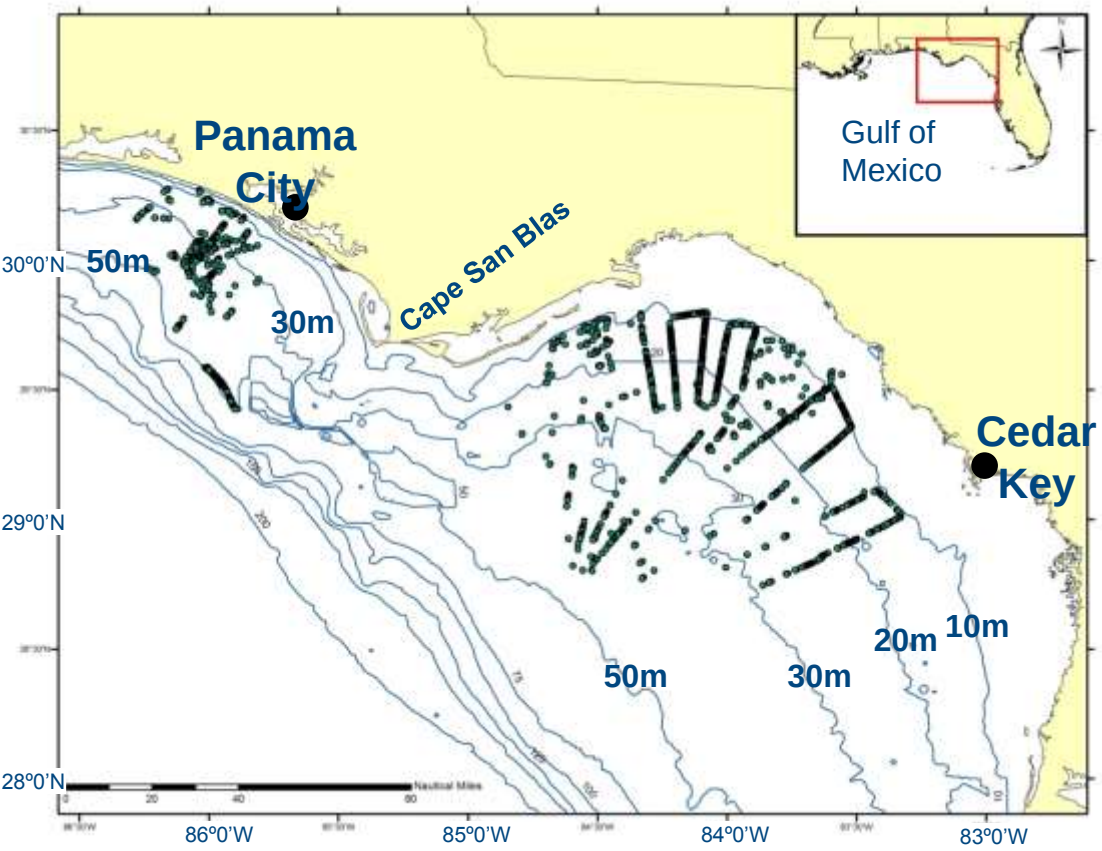
- 2014: Next generation stereo cameras will come online
- Wider viewing angle allowing for fish measurements (VMS) at greater distances
- Exploration of the use of DIDSON technology to assist in turbid and low-light environments
- Identification of specific gag spawning aggregation sites and evaluation of those using DIDSON (spawning behaviors are primarily nocturnal)
- Evaluation of MPA performance against reference areas close in proximity to evaluate ‘spill-over’ effect

Panama City Lab Fishery-Independent Reef Fish Survey

NOAA FISHERIES

Objectives: Produce age-based annual indices of abundance of reef fishes occurring on rocky reefs and live bottom in inner and mid-shelf waters (8-50m).

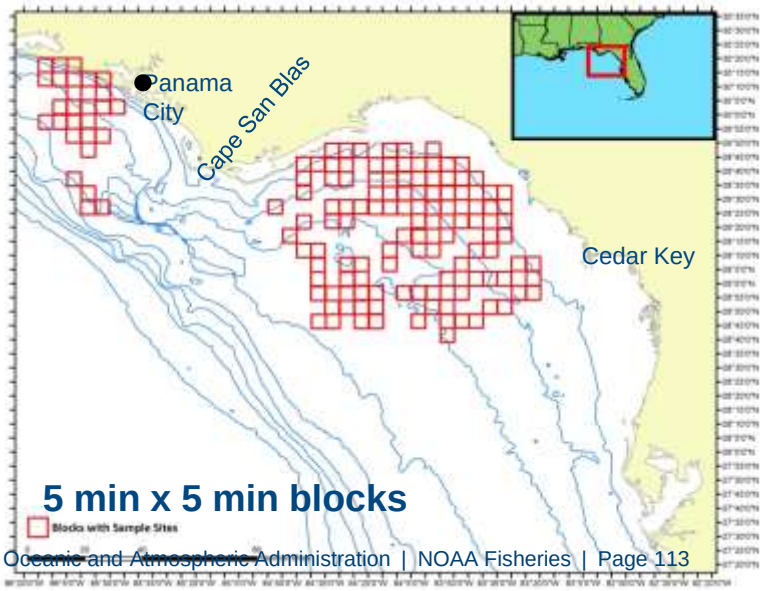


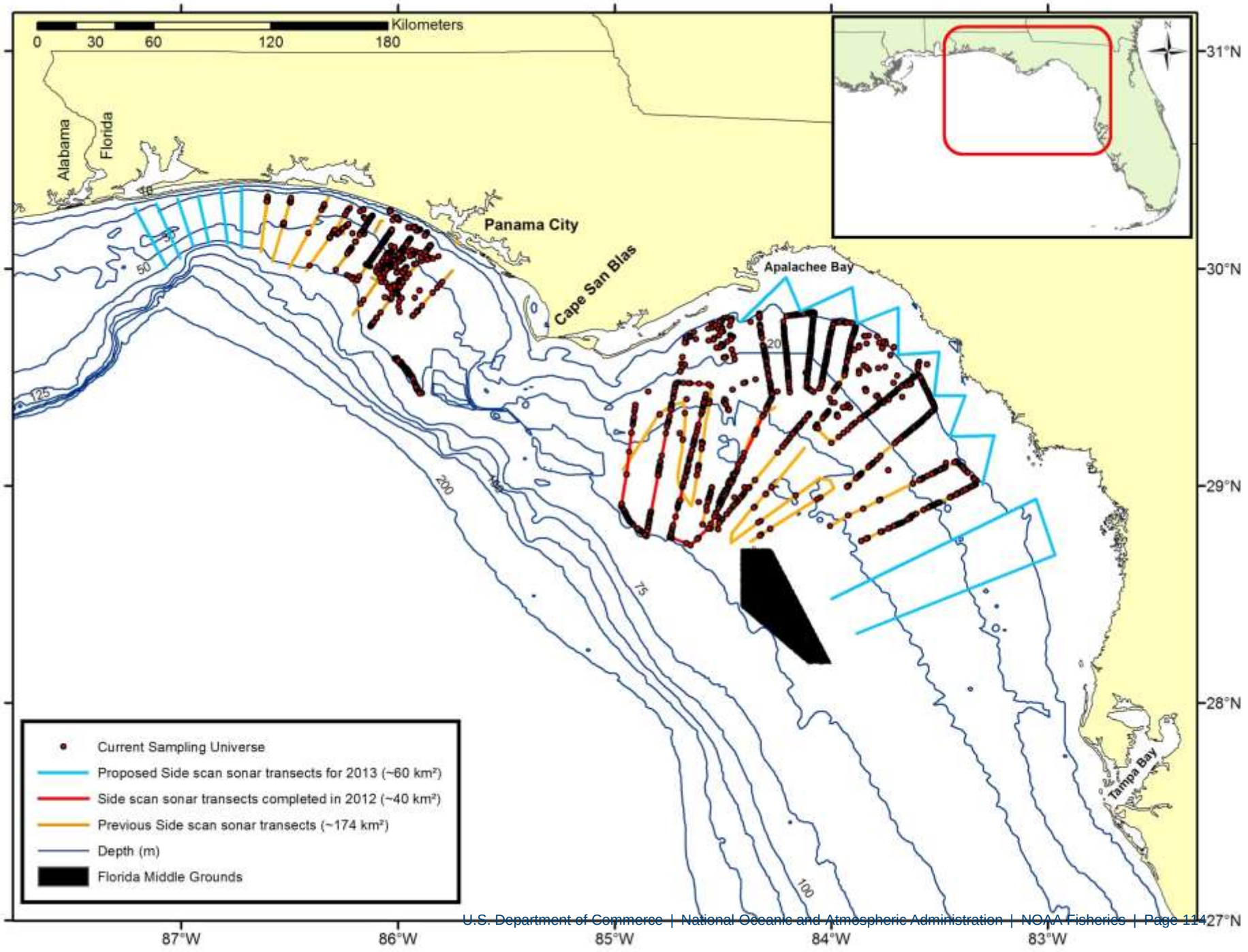


Low relief hard/live bottom 7-50 m

Survey Design

- 2004-09: Systematic – small sampling universe
- 2010 – : 2 stage random w/ proportional allocation by region, subregion, & depth (10-20, 20-30, 30+ m) – side scan survey greatly increased sampling universe
- Randomly select 5x5 min grids (weighted by numbers of sites)
- Then randomly select 2 sites (weighted by quality) within selected grids




Kilometers
0 30 60 120 180
Alabama
Florida
Panama City
Cape San Blas
Apalachee Bay
Tampa Bay
Current Sampling Universe
Proposed Side scan sonar transects for 2013 (~60 km²)
Side scan sonar transects completed in 2012 (~40 km²)
Previous Side scan sonar transects (~174 km²)
Depth (m)
Florida Middle Grounds
31°N
30°N
29°N
28°N
27°N
87°W
86°W
85°W
84°W
83°W

Gear

Stationary camera arrays

- High def video & stereo cameras
- ~30 min video collected, daytime only
- Used at every site
- Provides counts, size, habitat & behavior data
- Much less selective than traps & much lower CVs
- Not useful in bad visibility & provides no age data

Chevron traps

- Same as MARMAP except 50% smaller throat
- 90 min soak, daytime only
- Used at every other site
- Provides ageing structures, sex data
- Not affected by bad visibility
- Size and considerable species selectivity
- High variability in catch rates
- Time consuming (high logistic cost)

Assessment Species

Red snapper
Vermilion snapper
Gray snapper
Gag grouper
Red grouper
Scamp
Black sea bass
Gray triggerfish
Greater amberjack
Hogfish
Red porgy
White grunt

South Atlantic Reef Fish Trap/Video Survey

NOAA FISHERIES

Multi-species survey targeting species within the snapper-grouper complex (> 100 species)

Focal species are hardbottom-associated; thus, survey targets hardbottom habitats






Background and History

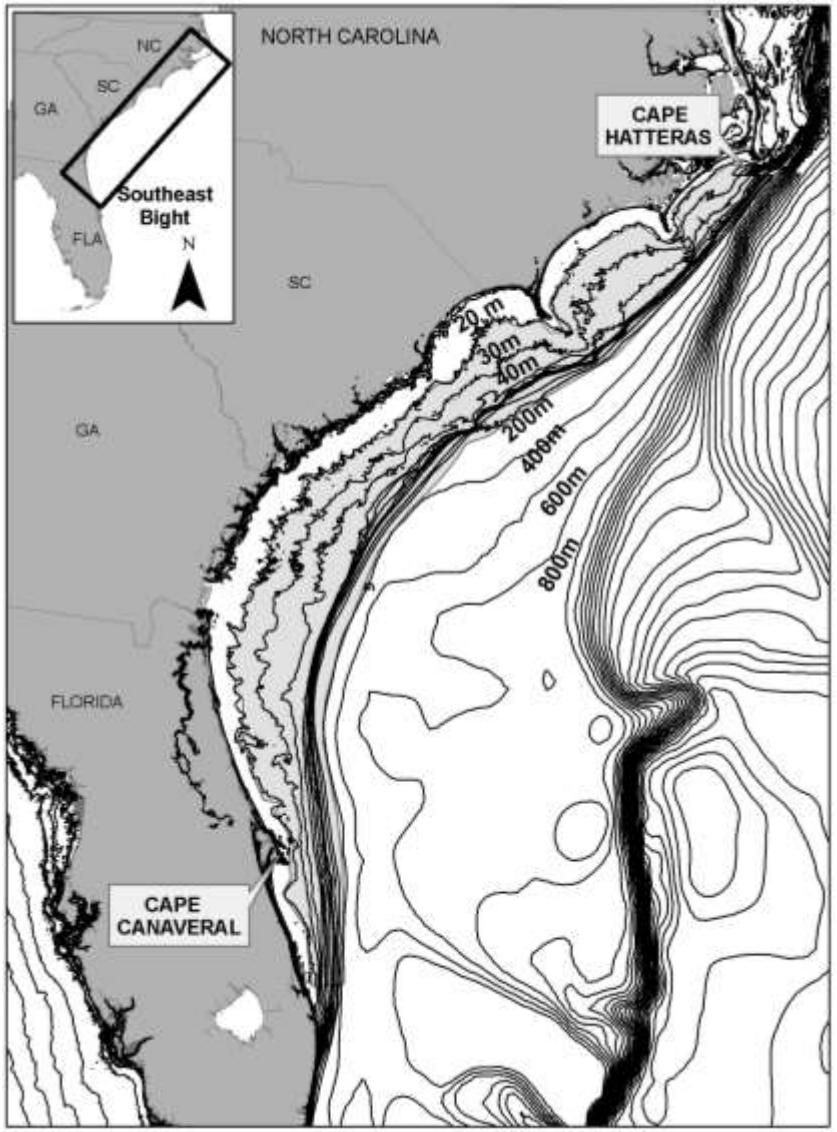
- Time series:
  - Chevron trap survey: 1990-present
  - Video survey: 2010-present

- Coordinating programs/agencies:
  - MARMAP/SEAMAP-SA (SCDNR; 1972-present)
  - SEFIS (NMFS SEFSC; 2010-present)

- Both groups work cooperatively to perform
- Trap-video survey in SA waters

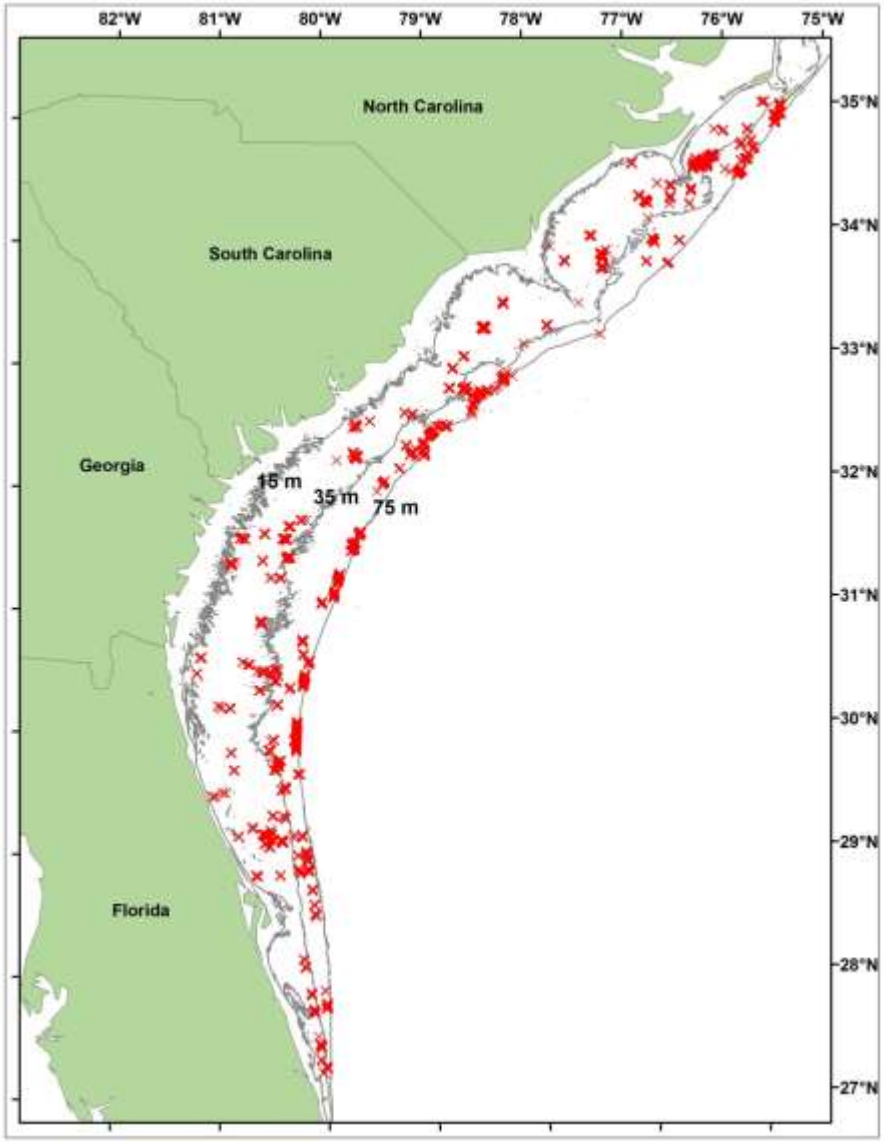
Area of focus

- Cape Hatteras, NC to Port St. Lucie, FL
- Depths: ~ 15 to 100m



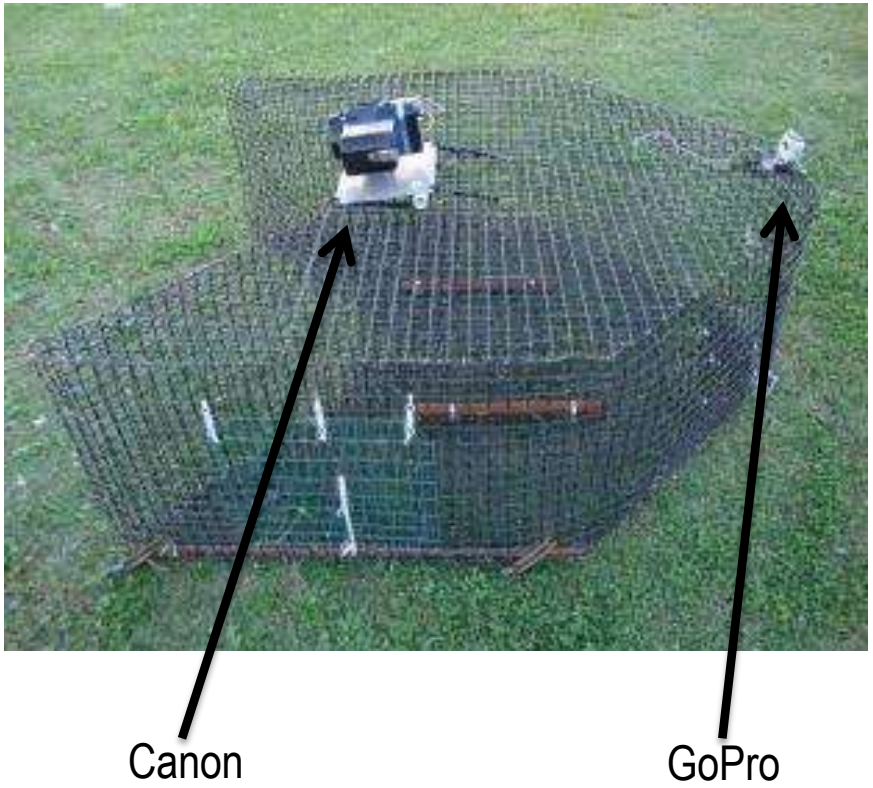
Survey design

- Survey universe N = 2,685 hardbottom sites
- Sites randomly selected each year N = ~ 1500
- Survey period: April - October



Gears

- Chevron trap
- Video cameras (outward-pointing)



Chevron trap methodology and data uses

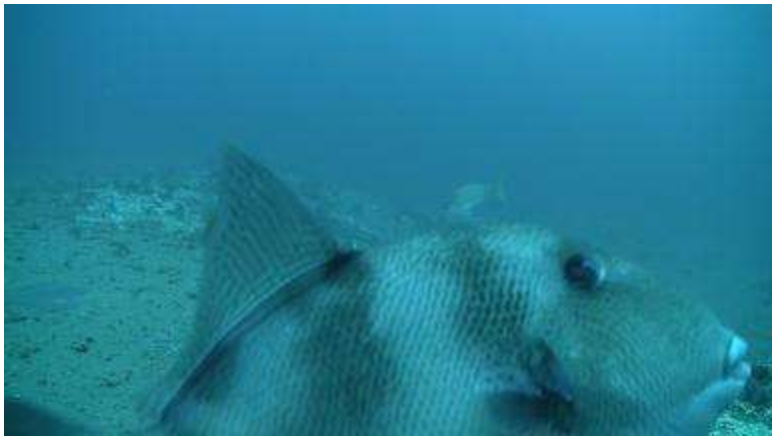
- ~90-minute soak time
- Baited with Atlantic menhaden
- Metric for abundance indices: CPUE (fish/trap/hr or fish/trap)
- Standardization approaches: delta-GLM and zero-inflated models

Additional data outputs:

- Annual length and age composition by species
- Length and age at sexual maturity and transition
- Spawning season, spawning periodicity, sex ratios, and fecundity
- Species composition, diet, and stock genetics

Video reading methodology

- MeanCount approach of Conn (2011)
- Fish of priority species counted in series of “snapshots” taken every 30 seconds (*N*=41)
- 10 to 30 minutes after trap lands on bottom
- Conn (2011) and Schobernd et al. (in review) have shown MeanCount tracks linearly with actual abundance



Used in assessments

Trap survey:

- Indices of abundance and length compositions:
  - black sea bass, gray triggerfish, red porgy, vermilion snapper, red grouper.
- Age, sexual maturity, sexual transition, fecundity:
  - all snapper-grouper species

Video survey:

- Indices of abundance:
  - expected first use in 2014 assessments (red snapper and red porgy)
- Age-growth & fecundity: NA

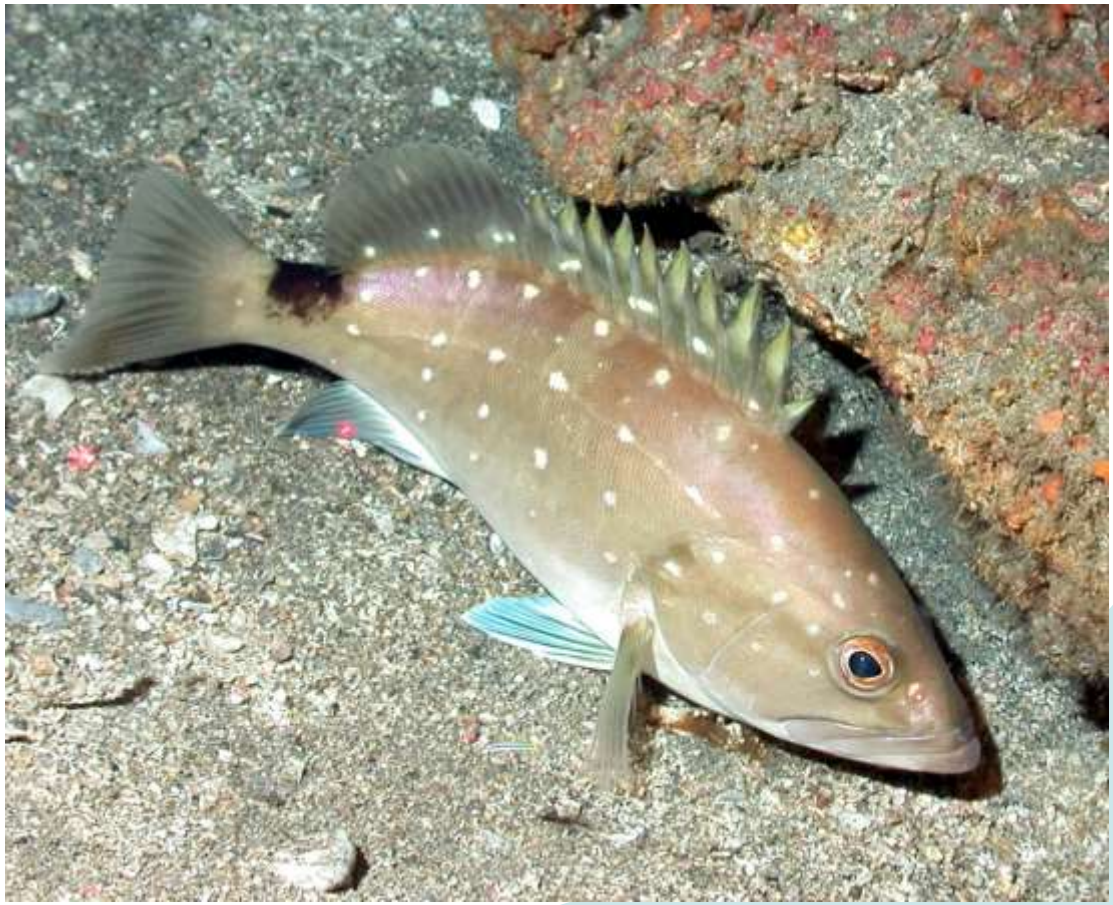
Used for management

Trap survey:

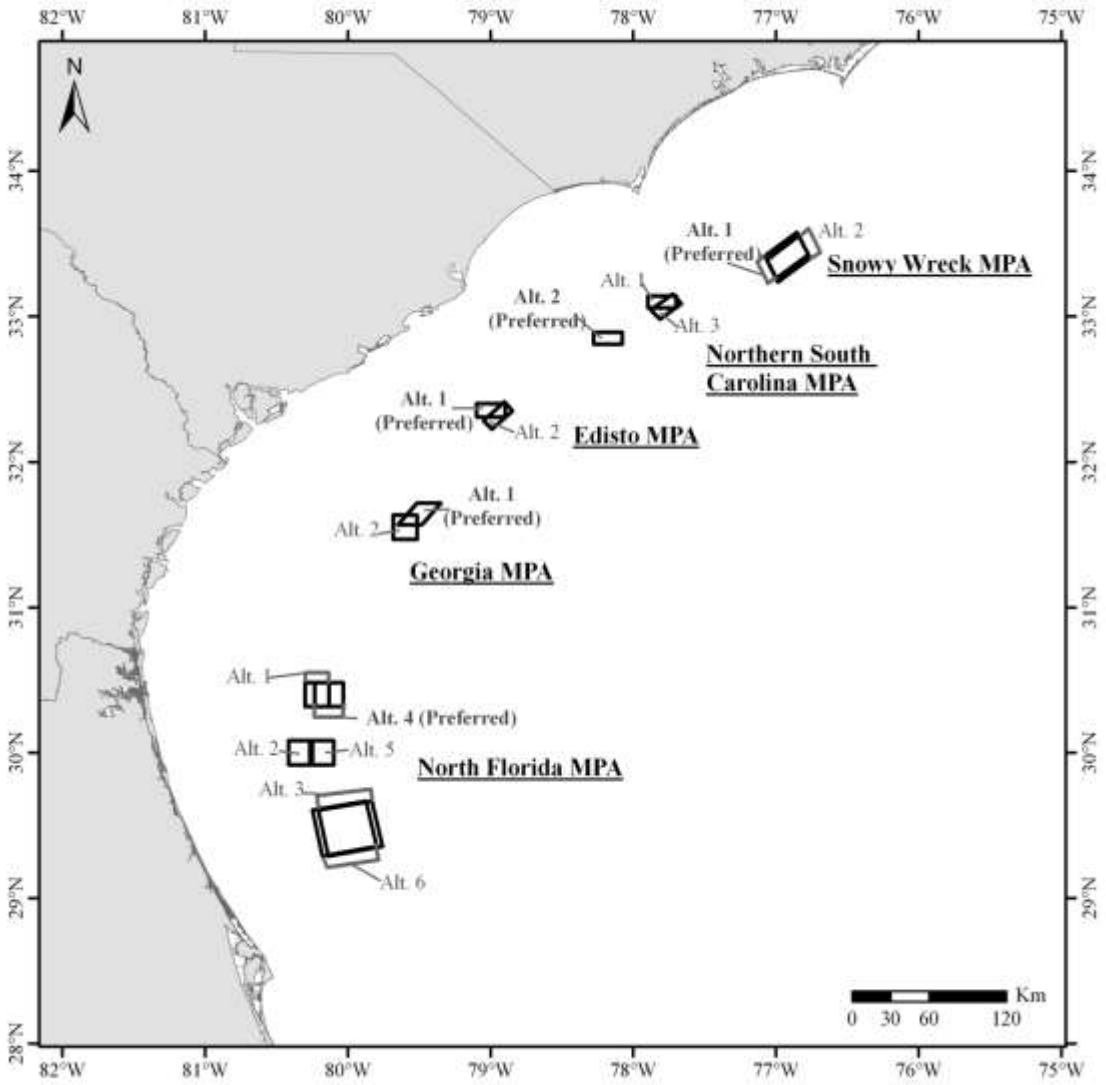
- Relative abundance (trends), length and age composition, species composition, spawning period and location, etc.
- Used by many agencies (e.g. SSC, SAFMC, SERO) for management recommendations/decisions
- Used in determining ABC levels, species groupings, SEDAR stocks assessment priorities, and MPA locations
- Snapper-grouper species

South Atlantic Bight
MARINE RESERVE PROGRAM

NOAA FISHERIES



Summary



East Coast: North FL to NC

Project began in 2004 with 14 site options for the final 5 MPAs.

All 14 were surveyed annually with sites selected as MPA used as experimental and non-selected sites as controls.

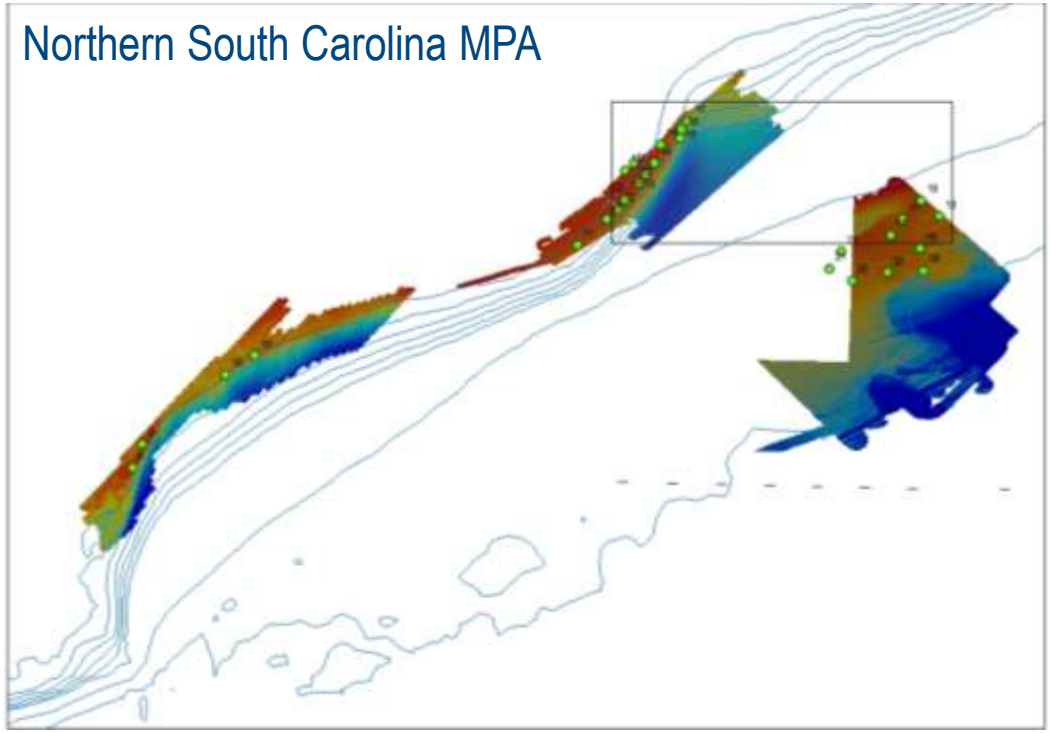
Data has been used by SAFMC for site selections of expanded and additional MPAs.

Survey Design and Methods

Sites are selected based upon bathymetric maps, known reef fish habitat and suspected habitat based on fishing vessels.

Phantom S2 ROV used for transect surveys. Dives of 2-4 hrs duration.

Other data collected: CTD, multibeam acoustic data, benthic sediment grabs.



Data Analysis

All fish are identified to lowest taxonomic level in transects which last 10 min or whenever habitat type changes for >30 sec. Habitats are divided into 5 strata.

Assessment Species

Grouper

Lionfish

Caribbean Surveys, Visual Surveys, and Other Surveys of the SEFSC

Caribbean Surveys

Survey	Description	Area of Operation	Frequency
Caribbean Reef Fish Survey	Surveys abundance of reef fish and elasmobranchs on the shelf waters of Puerto Rico and USVI using video cameras, fish traps, vertical lines and bottom longlines.	Puero Rico and U.S. Virgin Islands, continental shelf waters	Every two years, Mar-Jun
Caribbean Recruitment Experiment	Surveys ichthyoplankton forms of coral reef fish species in the U.S. Caribbean; develops larval indices for snapper, parrot fish, and grouper; and determines seasonal abundances, and population connections between islands and with the upstream sources.	Caribbean and Mexican waters	Bi-Annual, Feb or Jun
SEAMAP-Lane Snapper Bottom Longline Survey (Puerto Rico)	Surveys fish in the territorial waters of Puerto Rico. Data are collected on the biology, distribution, movements, and stock structure.	East, west, and south coasts of Puerto Rico in territorial waters at depths ranging from 15-300 ft.	Annual beginning 2015, (summer, winter, fall, spring)
SEAMAP-MARFIM Reef Fish Monitoring (Florida)	Survey monitors relative indices of abundance of reef fishes to determine patterns in community structure, and habitat associations, along with regional catch, recruitment, demographics, and distribution.	West FL shelf from 26 degrees N to Dry Tortugas, FL.	Annual, July-Sept
SEAMAP-Spiny Lobster Artificial Habitat Surveys (Puerto Rico)	Surveys juvenile spiny lobster recruitment to artificial shelters within the territorial sea of the U.S. Virgin Islands, Puerto Rico and the contiguous EEZ. During each survey the number of juvenile lobsters is counted within each shelter and carapace length measured. There is no extraction and/or collection of the resource.	U.S. Virgin Islands and Puerto Rico territorial waters in 6-90 ft depths	Annual, USVI, Jan-Dec; PR, Jan-Dec
SEAMAP-Yellowtail Snapper Rod-and-Reel Survey (Puerto Rico)	Surveys yellowtail snapper in the territorial waters of Puerto Rico. Data are collected on biology, distribution, movements, and stock structure.	East, west, and south coasts of Puerto Rico in territorial waters in depths from 15-300 ft	Annual beginning 2014, (summer, winter, fall, spring)

Caribbean Reef Fish Video Survey

NOAA FISHERIES

Objectives

- Survey reef fish species associated with hard bottom, high relief, topographic features of the Puerto Rico and the USVI
- Provide indices of relative abundance for use in stock assessments

Summary Information

Time series: 2009 & 2012

Coordinating agency: Southeast Fisheries Science Center

Area of focus: Continental shelf and shelf-edge banks

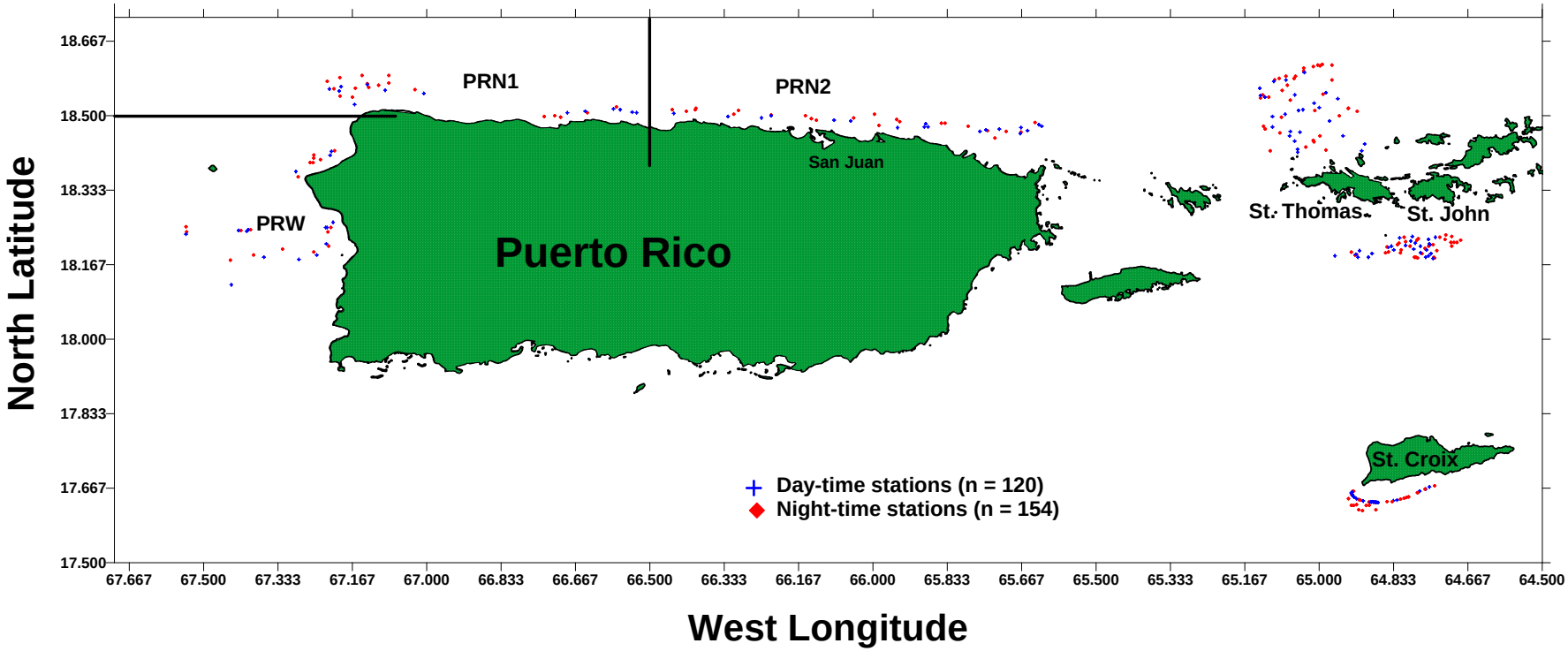
Region: Puerto Rico, St. Thomas, St Johns and St. Croix (USVI)

Depths: ~ 50 -150m

Duration: 30 days at sea

Platforms: NOAA ships

Survey Design



- A stratified random design was employed to select sample sites.
- Strata were defined by depth (50–60 m, 60–90 m; 90– 120 m; 120 to 300 m) and region (Northern Puerto Rico, Western Puerto Rico, St. Croix, southern St. John/St. Thomas and northern St Thomas).
- ~150 total sites sampled per year with video
- ~150 total sites sampled per year with vertical line gear
- Acoustic biomass at all sites

Survey gears

- Video and still cameras have been used and have evolved with time
- Current: 4 orthogonally placed stereo cameras with HD video
- Maximum depth 150 m

- Chevron fish traps & vertical line – hard parts and reproductive organs

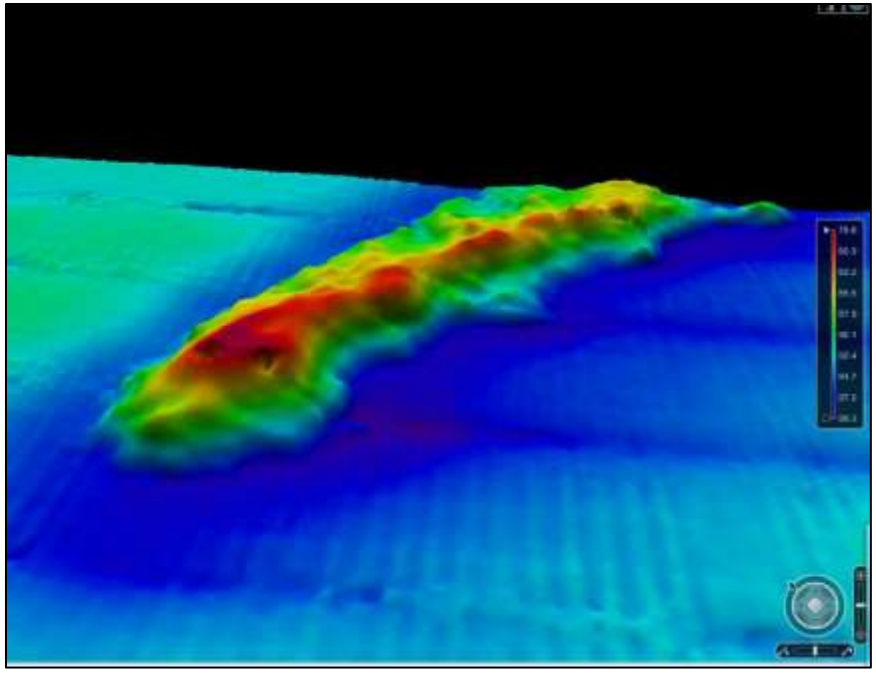
- Environmental Sampling Gear: Seabird SBE 9/11 Plus CTD, water profiler with sensors: temperature, pressure (depth), dissolved oxygen, fluorometer and transmissometer. CTD cast deployed during drift, surface to maximum depth.

Acoustic Gears

ME-70 multi-beam
EK-60 split-beam
Edgetech side-scan sonar

- Essential to survey improvement
- Expansion of block universe
- Reef delineation
- Habitat characterization
- AUV recently acquired

- Acoustic biomass data collected continously. ME-70 & EK-60
- Acoustic biomass protocols and processing still being refined



Projection developed from ME-70 multi-beam data

Video read method
Abundance and min-count

- One of four tapes from a station randomly selected for viewing
- Videos with obstructed views from physical objects, dark turbid water, and camera malfunctions are excluded from analysis
- Videos are viewed for twenty minutes starting from the time the view clears from suspended sediment
- Viewers identify, and enumerate all FMP species and estimate abundance using the min-count procedure
- Min-count is defined as the maximum number of individuals of one species that occur simultaneously on the video at one moment in time
- Min-count avoids problems of independence and double counting of fish
- Lengths of fish are only measured at point of min-count

Assessment support

SEDAR and indices

SEDAR 26, Stock assessment Report, Caribbean queen snapper
SEDAR 26, Stock assessment Report, Caribbean redtail parrotfish.
SEDAR 26. Stock assessment Report, Caribbean silk snapper.

Survey future

- ME70 data processing coming online after 3-4 years of work
- 2014: Next generation stereo cameras will come online
- Wider viewing angle allowing for fish measurements (VMS) at greater distances
- Exploration of the use of DIDSON technology to assist in turbid and low-light environments
- Continued streamlining habitat classification system with CMECS
- Coordination with NOS – Beaufort on multi-beam mapping and acoustic biomass data

Visual Surveys

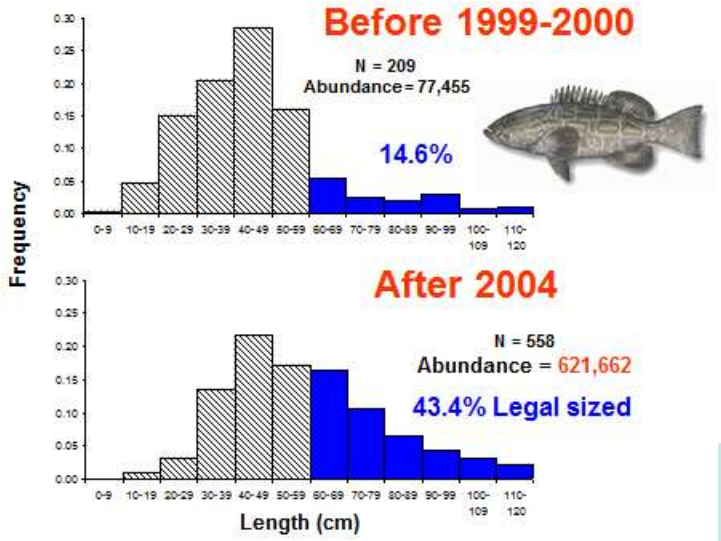
Survey	Description	Area of Operation	Frequency
Reef Fish Visual Census (RVC) NMFS	Visual survey of coral reef fish species composition, abundance, size structure and reef habitat features (depth, topography, benthic composition) at stratified random sites (< 33 m) using NMFS-NPS-FWC-UM 177 m^2, 15 dia circular plots).	Florida Keys Dry Tortugas Southeast Florida Flower Gardens Navassa Is	Annual May-Sep
Reef Fish Visual Census (RVC) NOS	Visual survey of coral reef fish species composition, abundance, size structure and reef habitat features (depth, topography, benthic composition) at stratified random sites (< 33 m) using NOS 100m^2, 25x4m linear transects.	Puerto Rico U.S. Virgin Is.	Annual May-Sep
SEAMAP Queen Conch Visual Survey	Visual SCUBA survey of queen conch abundance and density along predetermined compass headings using diver propulsion vehicles between 3 and 28m. No extraction or collection of queen conch.	Territorial sea and contiguous EEZ of Puerto Rico and U.S. Virgin Islands	Annual USVI Jun-Oct, Puerto Rico Jul-Nov

Coral Reef Habitat and Reef Fish Visual (RVC)Surveys – Southeastern U.S.

NOAA FISHERIES SEFSC

Objectives: Monitor and detect trends in reef fish species composition, abundance, and sizes on a spatially explicit basis to assess MPA management zone effectiveness and support length-based fishery stock assessments at habitat, management zone, and ecosystem-level spatial scales.

Dry Tortugas changes



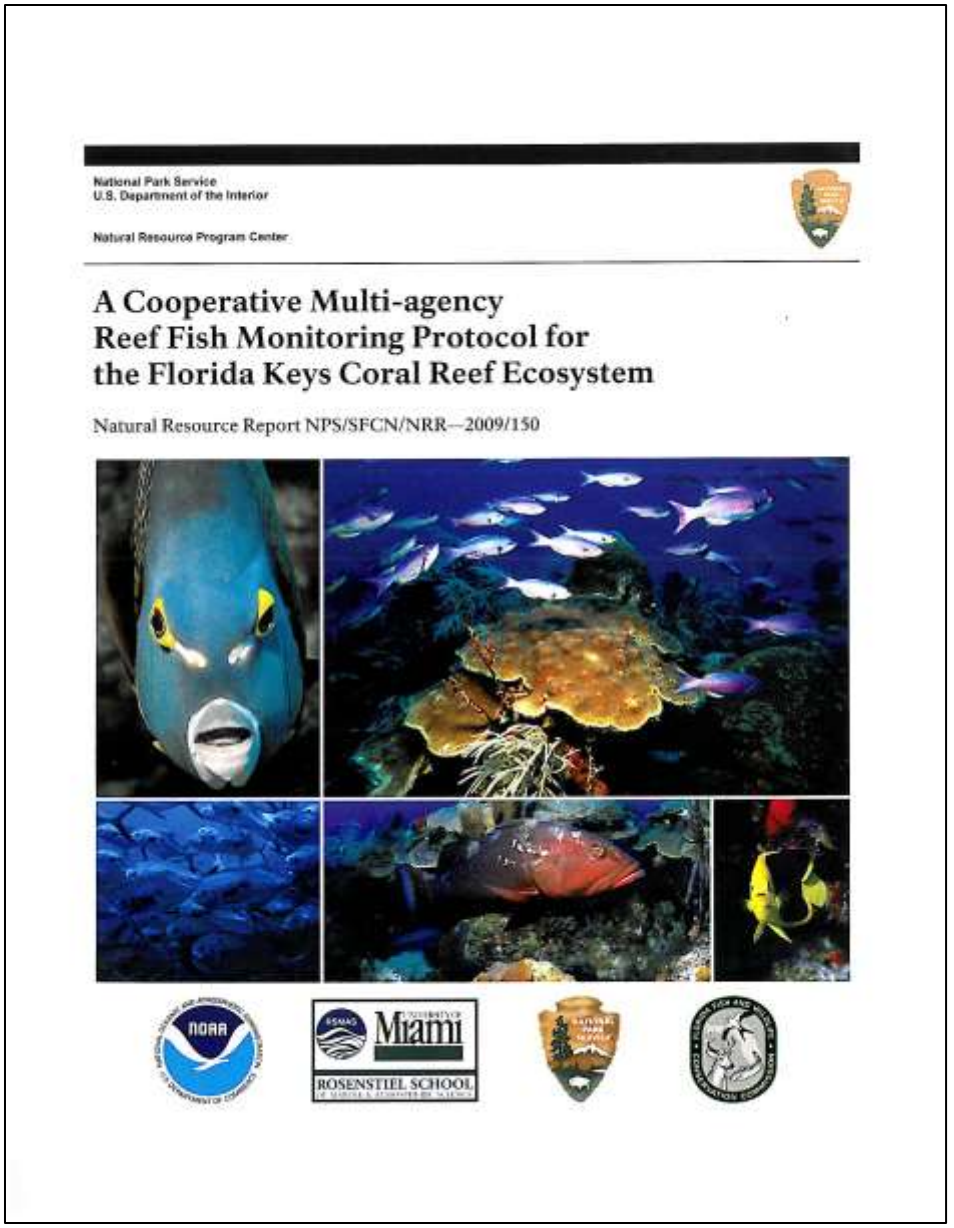
Collaborations

This survey is a multi-agency effort to monitor coral reef fish populations and habitat in the SE U.S. and U.S. Caribbean .

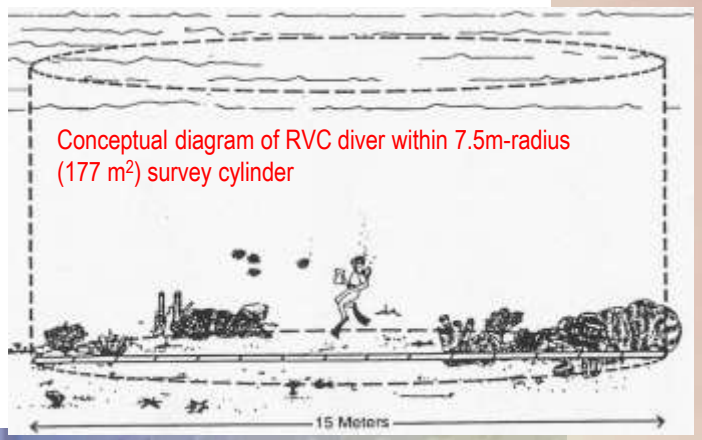
Agencies include:

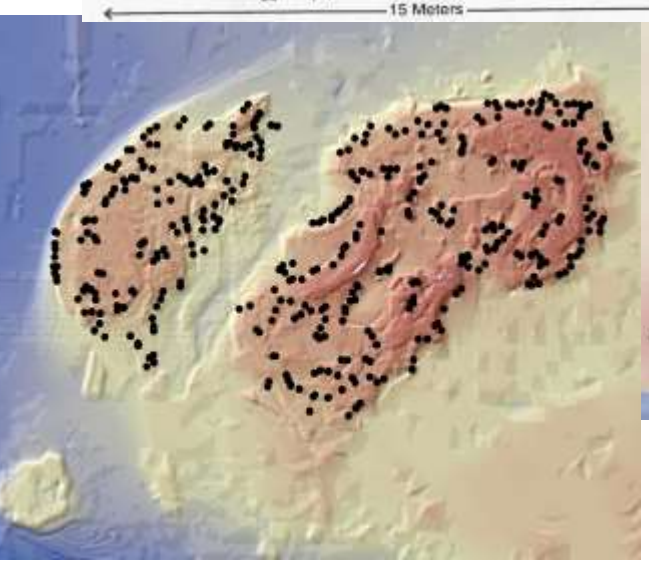
- NOAA SEFSC
- Florida Fish and Wildlife Conservation Commission's Florida Fish and Wildlife Research Institute (FWRI)
- University of Miami's Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)
- National Park Service (NPS).
- NOAA NCOSS (NOS)

This collaborative effort is the culmination of nearly three decades of independent Florida Keys monitoring programs aimed at assessing fish populations in the region.

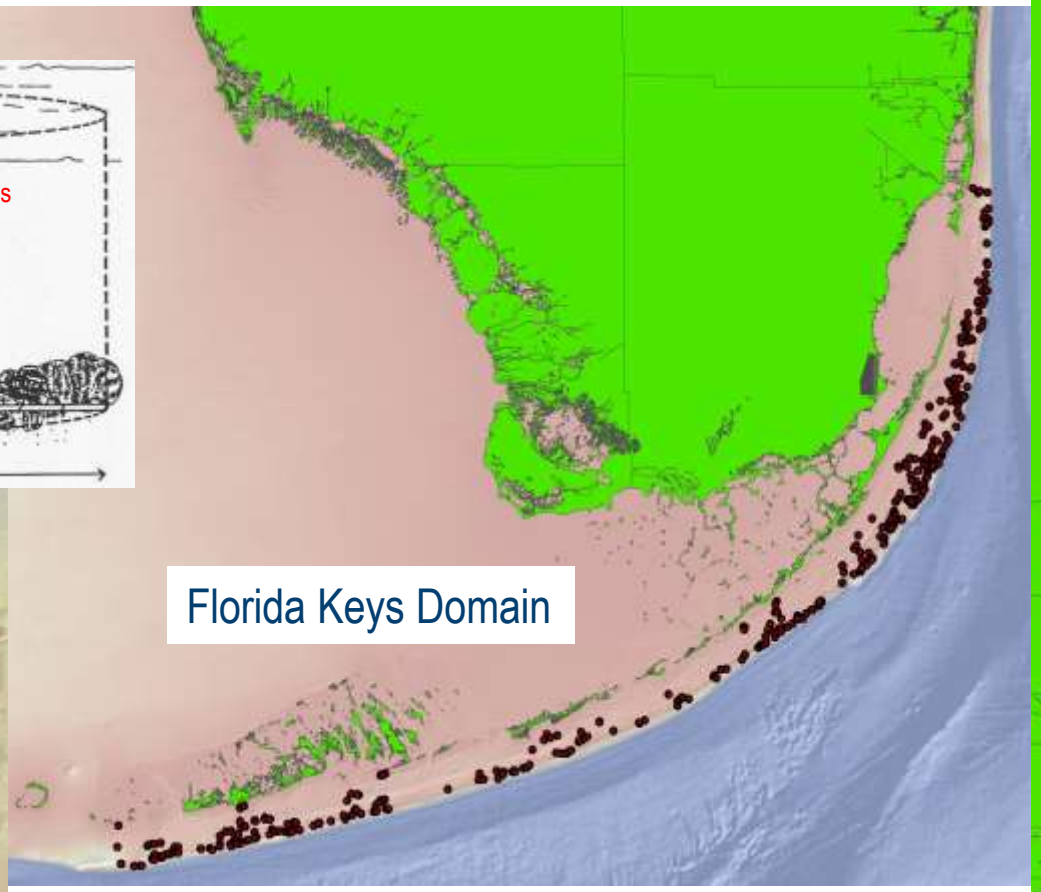


2012 RVC (Reef fish Visual Census) Florida sampling stations in 3 Domains

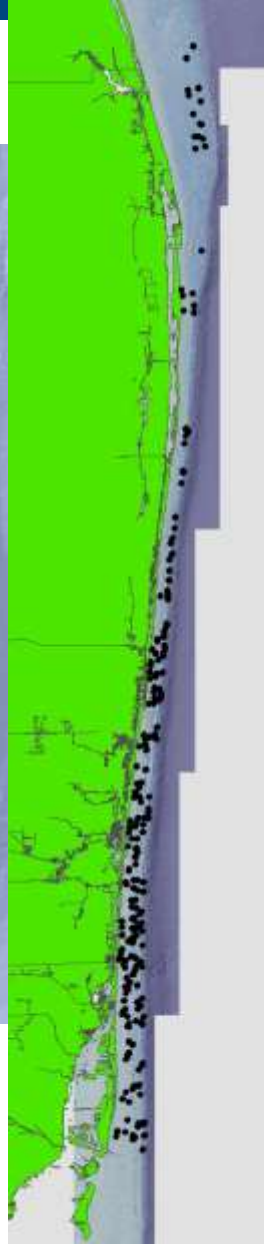




Dry Tortugas Regional Domain



Florida Keys Domain



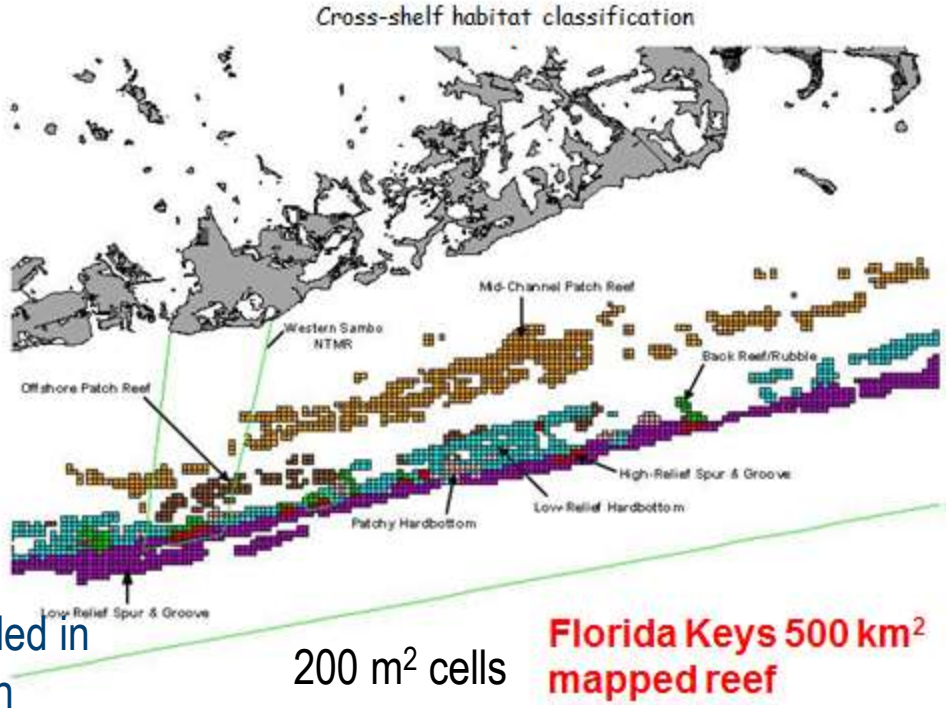
SE Florida Domain (SEFCRI)

Southeast Florida Coral Reef Initiative
(Miami-Dade to Martin County)

Survey Design

- May-Sep, annual in Florida Keys, biennial in Tortugas
- Two stage stratified random design
- Sampling domains are partitioned into 200 x 200 m primary unit cells; each assigned to a stratum based on:
  - Cross-shelf habitat type
  - Habitat relief and patchiness
  - Depth (max 33m)
  - Geographical subregion
  - Spatial Management Zone

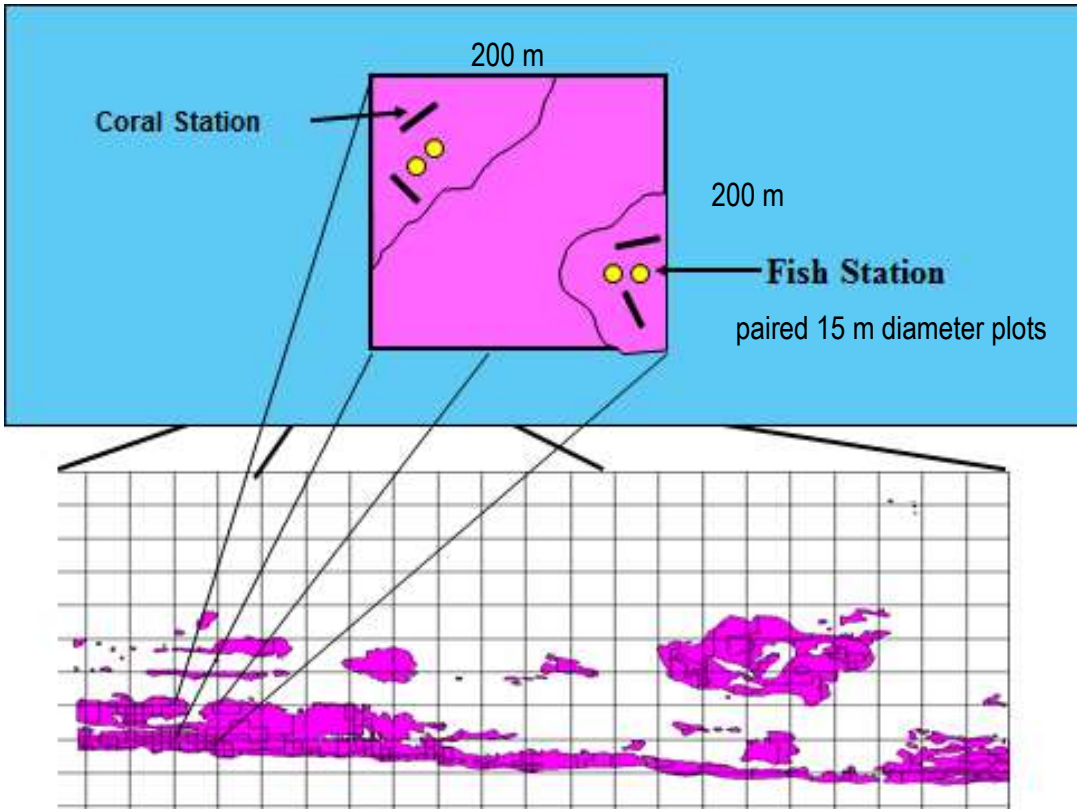
  (e.g, no-take reserves, angling only)

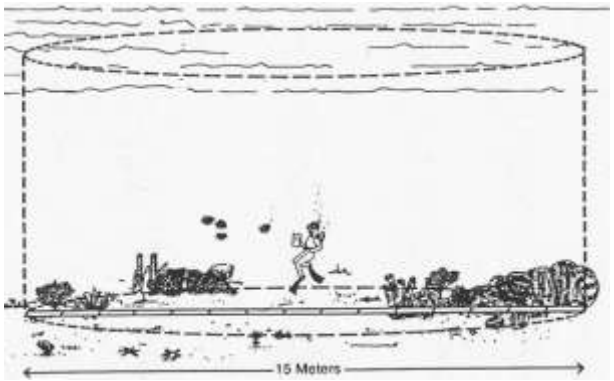


- The number of primary units to be sampled in each stratum type is based on a Neyman allocation scheme, which accounts for the stratum's size and the strata standard deviations for eight focal fish species densities.

Survey Design cont.

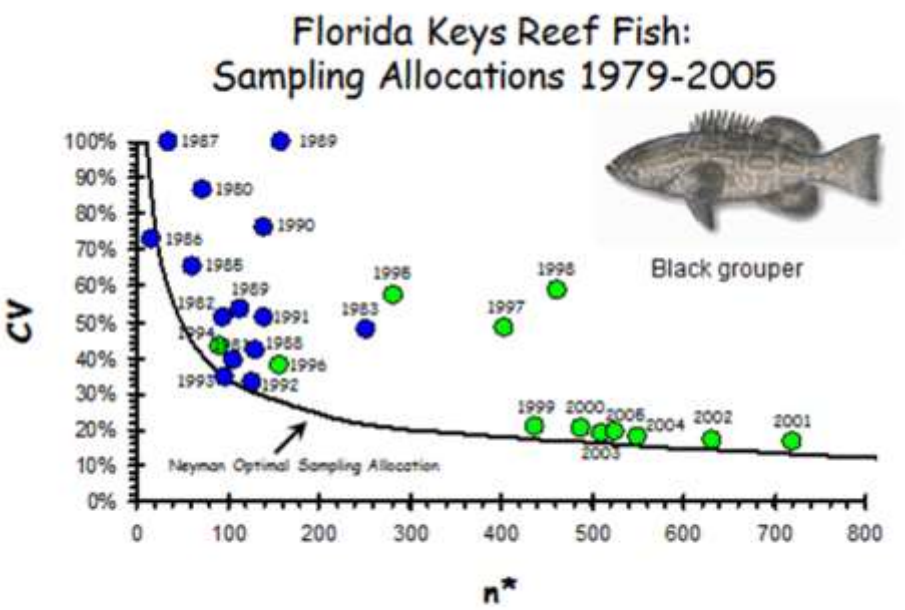
- Primary units to be sampled are randomly selected from a list of all possible primary units for each stratum. Within each selected primary unit, two smaller second-stage units are haphazardly selected.
- Each second-stage unit consists of a buddy pair of divers who each census all visible fishes in a 15 m diameter ($177 m^2$) circular plot.





Assessment Species

- The number of primary units sampled in each stratum type is based on a Neyman allocation scheme, which accounts for the stratum's size and the strata standard deviations for eight focal fish species densities.



Blue = simple random sites
Green = stratified random sites

Survey optimized for eight focal species:

- White grunt (*Haemulon plumieri*)
- Bluestriped Grunt (*H. sciurus*)
- Hogfish (*Lachnolaimus maximus*)
- Mutton Snapper (*Lutjanus analis*)
- Gray Snapper (*L. griseus*)
- Yellowtail Snapper (*Ocyurus chrysurus*)
- Red Grouper (*Epinephelus morio*)
- Black Grouper (*Mycteroperca bonaci*).

Survey data include ~ 280 fish species, benthic and macro invertebrates (corals, *Diadema*, conch, spiny lobster)

SEAMAP Queen Conch Visual Survey - U.S. Caribbean

NOAA FISHERIES
SEFSC

These surveys collect data on queen conch size and abundance within the territorial sea of the U.S. Virgin Islands, Puerto Rico and the contiguous EEZ.

- Survey Methods
  - U.S. Virgin Islands and Puerto Rico territorial waters in 10-90 ft depths, some sampling occurs in federal waters.
  - Annual, USVI, Jun-Oct; PR, Jul-Nov
  - Queen conch abundance and density are estimated by visual census surveys conducted along predetermined compass headings by SCUBA divers using diver propulsion vehicles.
  - There is no extraction and/or collection of queen conch.
  - Radial surveys (10m radius)
  - Measure all conch (shell length and lip thickness)

- Species Targeted
  - Queen conch

Gulf of Mexico Shark Pupping and Nursery (GULFSPAN) Survey

NOAA FISHERIES
SEFSC

Objective: Mid-water gillnet survey to monitor juvenile shark populations in the coastal Gulf of Mexico.

- **Summary**
  - 2001 through current year
  - April 1 through October 31
  - 0700 – 1700

- **Gear**
  - 600’ (186 m) gillnet
  - 6, 100’ panels, 10’ deep
  - Variable stretched-mesh sizes (3.0 - 5.5”)

- **Useful in Assessments**
  - SAFE reports for NOAA’s Sustainable Fisheries Division
  - Yearly report to NOAA’s Highly Migratory Species Office
  - Catch series for shark stock assessments

- **Collaborations**
  - NOAA Fisheries Panama City Laboratory (2001-current)
  - GCRL at the University of Southern Mississippi (2003-current)
  - Louisiana State University (2003-2005)
  - FMNH at the University of Florida (2006-2011)
  - Dauphin Island Sea Lab (2007-current)
  - Florida State University CML (2007-current)
  - University of West Florida (starting in 2013)

Sampling Areas (from west to east)

Louisiana State University

- Timbalier Bay, LA

GCRL at University of Southern Mississippi and Dauphin Island Sea Lab

- Mississippi Sound, Mobile Bay, & inside and outside barrier islands in MS and AL

University of West Florida

- Escambia Bay & Choctawhatchee Bay, FL

NOAA Fisheries Panama City Lab

- St. Andrew Bay, Crooked Island Sound/St. Andrew Sound, St. Joseph Bay, Gulf-side St. Vincent Island, & Apalachicola Bay, FL

FMNH at University of Florida & Florida State University CML

- St. George Sound to Anclote Key, FL

Example of Data Collected

Page _____ of _____

Shark Abundance Assessment Project
Shark Population Assessment Group
NOAA Fisheries Panama City Laboratory Panama City, FL
GILLNET EFFORT SHEET

SET SPECIFICS
GEAR COLLECTION # (#/YEAR): _____

AREA (AB = Apalachee Bay; APL = Apalachicola Bay; CIS = Crooked Island Sound; IP = Indian Pass Gulf-side of Apalachicola Bay; SAB = St. Andrews Bay; SJB = St. Joseph Bay): _____

LATITUDE: _____ LONGITUDE: _____ MONTH: _____ DAY: _____

GEAR SET TIME (in hundredth hr): _____ GEAR HAUL TIME (in hundredth hr): _____

ENVIRONMENTAL
WATER TEMPERATURE (°C): _____

SALINITY (parts per thousand): _____

DEPTH (METERS from depth finder): _____

TURBIDITY (depth photic zone in CM): _____

DISSOLVED OXYGEN (MG/L): _____

PREDOMINANT BOTTOM TYPE (MUD, SEAGRASS, SAND, OYSTER, OTHER: DEFINE) _____

Page _____ of _____

GILLNET CATCH SHEET

SET SPECIFICS
GEAR COLLECTION # _____ CHECK # _____
CHECK TIME: BEGIN _____ CHECK END _____

CATCH WORKSHEET

MESH						
SPECIES						
PCL						
FL						
TL/DW						
STL						
SEX						
MAT STATE						
TAG						
BYCATCH – #						
BYCATCH LENGTHS						

Species Collected

- Sharks
  - Atlantic sharpnose
  - Blacknose
  - Blacktip
  - Bonnethead
  - Bull
  - Finetooth
  - Florida smoothhound
  - Great hammerhead
  - Sandbar
  - Scalloped hammerhead
  - Spinner
- Rays/Skates
  - Atlantic guitarfish
  - Atlantic stingray
  - Bluntnose ray
  - Clearnose skate
  - Cownose ray
  - Devil ray
  - Smooth butterfly ray
  - Spotted eagle ray
  - Southern stingray
- Teleosts
  - Atlantic bumper
  - Atlantic croaker
  - Bluefish
  - Blue runner
  - Cobia
  - Florida pompano
  - Gaftopsail catfish
  - Hardhead catfish
  - Harvestfish
  - Inshore lizardfish
  - Kingfish
  - Ladyfish
  - Menhaden
  - Seatrout
  - Spanish mackerel
  - Spot

Species Tagged

- Sharks
  - Atlantic sharpnose
  - Blacknose
  - Blacktip
  - Bonnethead
  - Bull
  - Finetooth
  - Florida smoothhound
  - Great hammerhead
  - Sandbar
  - Scalloped hammerhead
  - Spinner
- Rays/Skates
  - Cownose ray

Note: All collaborating institutions use the same tags. Tag and recapture data for the Gulf of Mexico is housed in a central and standardized Access database at the NOAA Fisheries Panama City Laboratory.

Database & QA/QC

- Collaborating institutions house their own data, run their own analyses (CPUE and habitat associations), and build their own tables and figures separately for end of year report.

- NOAA Fisheries Panama City Lab
  - Access Database
  - Co-PI enters data after each field expedition
  - Data proofed at the end of field season (Nov 1)

- NOAA Fisheries Panama City Lab organizes written section, tables, and figures of end of year report and then sends to HMS, usually in January.

NOAA FISHERIES
SEFSC

Smalltooth Sawfish Abundance Survey

Recovery Plan Objectives

- *"…protect and/or restore smalltooth sawfish habitat."*
  - Studies should provide valuable information that can be used to identify the salinity tolerance and/or environment preference levels required for the species conservation and recovery.

- *"…ensure smalltooth sawfish abundance increases substantially, and the species reoccupies areas from which it had been previously extirpated."*
  - Implementation and the continuation of ongoing relative abundance surveys are necessary to ensure this recovery criterion is met and to monitor increases in smalltooth sawfish abundance.

Survey Design

• Monthly sampling (Mar-Nov) using gillnets

•Gillnets set using a randomized stratified design based on depth

• Nets checked and cleared every 0.50 hours or immediately if any catch was observed in the gear

•Activities permitted under:

•ENP Permit # ENP-2011-SCI-0010

•Protected Species Permit # SEFSC-NMFS-13330

•Protected Species Permit # FFWCC-1475

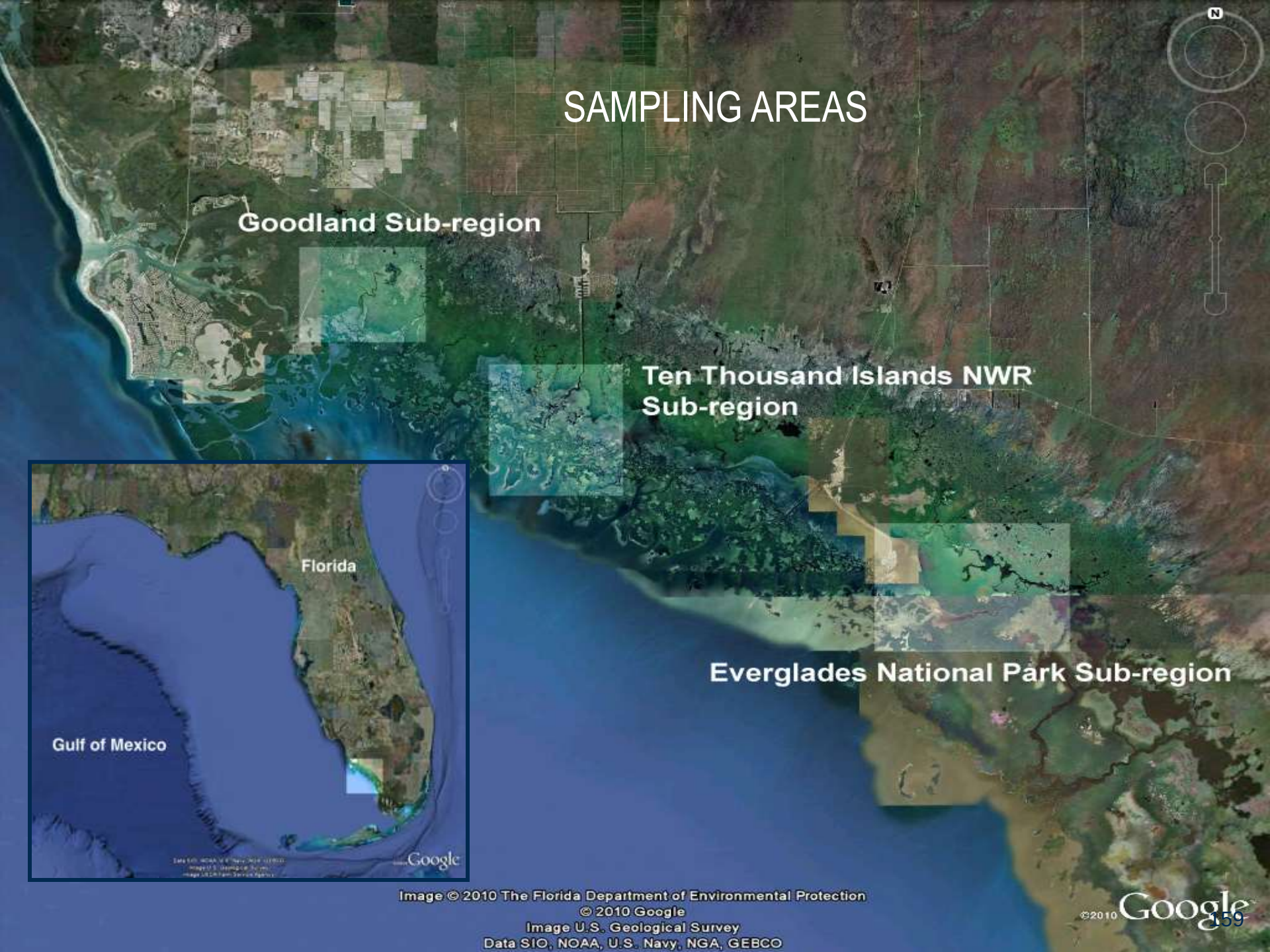

SAMPLING AREAS
Goodland Sub-region
Ten Thousand Islands NWR Sub-region
Everglades National Park Sub-region
Florida
Gulf of Mexico
Google
Image © 2010 The Florida Department of Environmental Protection
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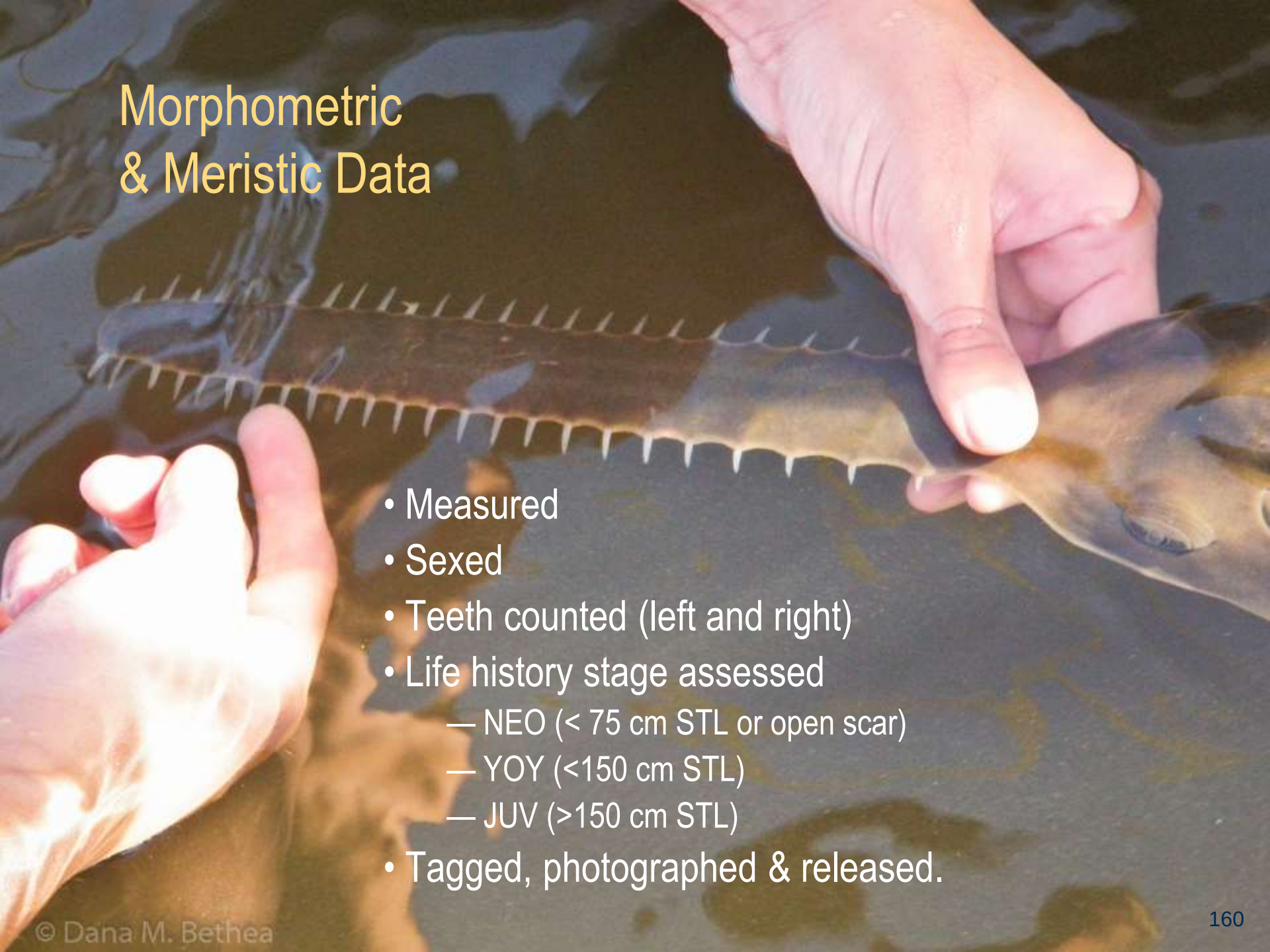
Image U.S. Geological Survey
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google

Morphometric & Meristic Data



- Measured
- Sexed
- Teeth counted (left and right)
- Life history stage assessed
  - NEO (< 75 cm STL or open scar)
  - YOY (<150 cm STL)
  - JUV (>150 cm STL)
- Tagged, photographed & released.

Habitat Profiles

- Water temperature (°C)
- Salinity
- Dissolved oxygen (mg/L and % saturation)
- Depth, using gear start and end points (in meters)
- Water clarity (depth of the photic zone in cm)
- Tidal stage
- Bottom type and shoreline habitat

In Summary

- Fifty-three annual surveys or special projects mentioned or described.
- There are no less than 22 collaborating non-NMFS groups that participate; plus numerous other collaborating scientists on specific surveys as volunteers.
- At least 36 assessments species/species groups are currently covered by the surveys.
- Over 700 DAS are expended annually by SEFSC in support of assessment/management.
- Our surveys strive to be state-of-the-art with regards to research platforms, survey design, data collection and technology.
- Considering our extensive time-series data pool for these numerous surveys, our surveys are highly regarded and essential for numerous management efforts (SEDARs, ICCAT, etc.).

Assessment Species

Atlantic bluefin tuna,
Atlantic croaker
Atlantic Sharpnose shark
Black Grouper
Blacknose shark
Blacktip Shark
Bluestriped Grunt
Bonnethead
Brown, White, Pink Shrimp
Caribbean queen snapper
Caribbean redtail parrotfish
Caribbean silk snapper
Corals
Dusky shark
Gag grouper
Gray Snapper
Gray triggerfish
Greater amberjack
Hogfish
Horseshoe crab
King mackerel
Large coastal sharks
Mutton Snapper
Queen conch
Red Grouper
Sandbar shark
Small coastal sharks
Smalltooth sawfish
Spanish mackerel
Tilefish
Vermillion snapper
Weakfish
White grunt
Yellowedge grouper
Yellowtail snapper

QA/QC Tomorrow